

Two Eagle Vegetation Management Project- Existing Condition

Wildlife Specialist's Report

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Introduction

This analysis describes the terrestrial wildlife species found in the project area and the potential effects of the Two Eagle alternatives on these species. Rather than addressing all wildlife species, discussions focus on Forest Plan management indicator species (MIS), threatened, endangered and sensitive (TES) species, Forest Plan featured species, and landbirds (see individual species lists below). The existing condition is described for each species, group of species, or habitat. Direct, indirect and cumulative effects of alternatives are identified and discussed. Supporting wildlife documentation is located in the Project Record, and includes detailed data, methodologies, analyses, conclusions, maps, references and technical documentation used to reach conclusions in this environmental analysis.

Regulatory Framework

The three principle laws relevant to wildlife management are the National Forest Management Act of 1976 (NFMA), the Endangered Species Act of 1973 (ESA), and the Migratory Bird Treaty Act (MBTA) of 1918 (as amended). Direction relative to wildlife is as follows:

- NFMA requires the Forest Service to manage fish and wildlife habitat to maintain viable populations of all native and desirable non-native vertebrate wildlife species and conserve all listed threatened or endangered species populations (36 CFR 219.19).
- ESA requires the Forest Service to manage for the recovery of threatened and endangered species and the ecosystems upon which they depend. Forests are required to consult with the US Fish and Wildlife Service if a proposed activity may affect the population or habitat of a listed species.
- MBTA established an international framework for the protection and conservation of migratory birds. This Act makes it illegal, unless permitted by regulations, to “pursue, hunt, take, capture, purchase, deliver for shipment, ship, cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird.”

Forest Service Manual (FSM) direction provides additional guidance: identify and prescribe measures to prevent adverse modifications or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened and proposed species (FSM 2670.31 (6)).

The Forest Service Manual also directs the Regional Forester to identify sensitive species for each National Forest where species viability may be a concern. Under FSM 2670.32, the manual gives direction to analyze, if impacts cannot be avoided, the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole.

The principle policy document relevant to wildlife management on the Forest is the Wallowa-Whitman Land and Resource Management Plan (USDA Forest Service 1990), referred to as the Forest Plan for the remainder of this analysis. The Forest Plan provides standards and guidelines for management of wildlife species and habitats. Standards and guidelines are presented at the Forest level (LRMP, pp. 4-18 to 4-56) or Management Area level (LRMP pp. 4-56 to 4-98).

The 1995 Regional Forester's Eastside Forest Plan Amendment #2 (Eastside Screens) amended Forest Plans for the National Forests in Eastern Oregon and Eastern Washington, including the Wallowa-Whitman National Forest. Amendment # 2 established interim wildlife standards for old growth, old growth connectivity, snags, large down logs, and northern goshawks. The Regional Forester has periodically distributed letters clarifying direction in Amendment #2 (Regional Forester, October 2, 1997; October 23, 1997; and June 11, 2003).

Additional management direction is provided for the conservation of migratory landbirds. This direction is consolidated in the Forest Service Landbird Strategic Plan and further developed through the Partners in Flight Program. The Oregon-Washington Partners in Flight Conservation Strategy for Landbirds in the Rocky Mountains of Eastern Oregon and Washington (Altman 2000) identifies priority habitats, and focal species and habitats for the Blue Mountains of Oregon.

Analysis Methods

Different scales of analysis are used in this document to analyze the effects of the treatment activities on wildlife, and include the following:

- Two Eagle Project Area perimeter at 7,206 acres on National Forest System lands.
- Watershed level analysis more applicable to species population effects
- The cumulative effects area encompassing the Two Eagle Project Area varies by species and is described within sections dedicated to individual species analyses.

The project area boundary occurs within the Eagle Creek watershed.

The existing condition is described for each species, group of species, or habitat. Direct, indirect and cumulative effects of alternatives are identified and discussed. Incomplete or unavailable information, scientific uncertainty, and risk are disclosed where applicable.

Management Indicator Species (MIS)

The geographic ranges of the MIS are larger than the project area, thus the analysis of adequacy of habitats for viable populations of MIS needs to be done at a scale larger than the individual project. "Habitat must be provided for the number and distribution of reproductive individuals to ensure the continued existence of a species generally throughout its current geographic range" (FSM 2620.1). Provisions for contributing to viable populations are determined at the level of the Forest Plan through management requirements, goals and objectives, standards, guidelines, prescriptions, and mitigation

measures to ensure that habitat needs of MIS will be sufficiently met during plan implementation at the project level (FSM 2621.4). Analysis for each MIS includes an assessment of consistency with the provisions identified in the Forest Plan. Cumulative effects of proposed management activities on habitat capability for MIS are evaluated (FSM 2620.3). Best available science is considered in this analysis in assessing project impacts to MIS.

Landbirds including Neotropical Migratory Birds (NTMB)

Landbirds, including neotropical migratory birds, are discussed since many species are experiencing downward population trends. Discussion can be found in the section titled Landbirds including Neotropical Migratory Birds (NTMB).

Analysis Tools and Surveys

Species presence/absence determinations were based on habitat presence, past wildlife surveys, recorded wildlife sightings, the Oregon Natural Heritage Information Center wildlife sightings database (2008), scientific literature, and status/trend and source habitat trend documented for the Interior Columbia Basin (Wisdom et al. 2000).

Vegetation analysis and estimates of stand conditions were completed using silviculture analysis tables, aerial photo interpretation, vegetation database, and/or ground reconnaissance.

Analysis Methodology

Alternative 1, the No Action Alternative, is used as a benchmark to compare and describe the differences and effects between taking no action and implementing action alternatives. The No Action Alternative is designed to represent the existing condition; resource conditions are then projected forward in time to estimate resource changes expected in the absence of the proposed management activities.

Effects on species will be determined by assessing how the No Action Alternative and action alternatives affect the structure and function of vegetation relative to current and historical distributions. Some wildlife habitats require a detailed analysis and discussion to determine potential effects on a particular species. Other habitats may either not be impacted or are impacted at a level which does not influence the species or their occurrence. The level of analysis depends on the existing habitat conditions, the magnitude and intensity of the proposed actions, and the risk to the resources.

Present and reasonably foreseeable future activities used in cumulative effects analysis are listed in the EA, Appendix D. Where the species' cumulative effects analysis area is larger than the two subwatersheds encompassing projects listed in Appendix D, other sources are used to quantify these activities.

Management indicator species (MIS)

The LRMP identifies 5 wildlife species, or groups of species, as MIS (Table 1) (US Forest Service 1990). These species serve as indicators of the effects of management activities by representing habitat for a

broad range of other wildlife species. The habitat requirements of MIS are presumed to represent those of a larger suite of species using the same type of habitat. All MIS are present in the project area.

Table 1. MIS and Their Primary Habitats.

Species	Habitat
American marten	Old-growth and mature forest
Northern goshawk	Old-growth and mature forest
Pileated woodpecker	Old-growth and mature forest
Primary cavity excavators ¹	Snags and logs
Rocky Mountain elk	Cover and forage

¹ Northern flicker; black-backed, downy, hairy, Lewis', three-toed, and white-headed woodpeckers; red-naped and Williamson's sapsuckers; black-capped, chestnut-backed, and mountain chickadees; and pygmy, red-breasted, and white-breasted nuthatches

Rocky Mountain Elk

Rocky Mountain elk have been selected as an indicator of habitat diversity, interspersed cover and forage area, and security habitat provided by areas of low human disturbance. Elk management on the Wallowa-Whitman National Forest is a cooperative effort between the Forest Service and the Oregon Department of Fish and Wildlife (ODFW). The Forest Service manages habitat while ODFW manages populations by setting seasons, harvest limits, and goals for individual Wildlife Management Units (WMU). The Two Eagle project lies within the Keating WMU.

Potential elk habitat effectiveness may be evaluated using the Habitat Effectiveness Index (HEI; Thomas et al. 1988). This model considers the density of open roads, the availability of cover habitat, the distribution and juxtaposition of cover and forage across the landscape, and forage quantity and quality. More recently, Rowland et al. (2005) has proposed the use of distance band analysis (DBA) to better understand the effects of roads on elk security habitat.

Background Information

Rocky Mountain elk (*Cervus canadensis nelsoni*- hereafter elk) are an important big game species in northeastern Oregon (Csuti et al. 2001) and are an indicator of the quality and diversity of forested habitat (defined as $\geq 40\%$ canopy closure, USDA LRMP 1990) which includes an interspersed cover and forage areas, and security habitat provided by cover and low levels of human activity (Thomas 1979). It is commonly accepted that the other big game species (i.e. mule deer, white-tailed deer, black bear, and cougar) are at least partially accommodated when high quality elk habitat is present. Elk are habitat generalists; they exploit a variety of habitat types in all successional stages and their patterns of use change daily and seasonally (Toweill and Thomas 2002). Elk are quite responsive to land management activities, thus the density or health of elk populations (as opposed to examining

population trends) most likely indicate the effectiveness of elk management. (Toweill and Thomas 2002).

Logging generally results in increased elk forage, with declines in the short term (1-3 years), followed by large increases in forage that may last 10 years or longer (Wisdom et al. 2005b). Large-scale habitat manipulations are being conducted with increased frequency in western forests, and although fuels reduction via thinning or prescribed burning often is assumed to benefit wildlife (Toweill and Thomas 2002, Wisdom et al. 2005a), based on the interacting effects of fuels reduction and season on forage characteristics, Long et al. (2008) suggests that maintaining a "mosaic of burned and unburned forest habitat may provide better long-term foraging opportunities for elk than burning a large proportion of the stand on a landscape."

Displacement of elk from areas during human activities (e.g. logging, fuels reduction) is well documented (Edge 1982, Toweill and Thomas 2002, Wisdom et al. 2005a). Under most cases, this displacement is temporary, and there is no evidence that elk will not eventually return to harvested areas (Toweill and Thomas 2002). Of much more concern to resource managers are the establishment of roads associated with harvest activities that increase accessibility to recreationists (e.g. hunter, hikers, cross country skiers, OHV). Increased road use by recreationists has been shown to significantly reduce elk security (Toweill and Thomas 2002), increase stress levels (Creel et al. 2002), and increase elk vulnerability to mortality from both legal and illegal hunter harvest (Rowland et al. 2005).

Blue Mountain/WWNF Population Viability

The National Forest Management Act (1976) requires that habitat exist to provide for viable populations of all native and desired non-native vertebrates. Elk is a game species that is managed on a management objective (M.O.) basis. Management objectives were developed to consider not only the carrying capacity of the lands, but also the elk population size that would provide for all huntable surplus, and tolerance levels of ranchers, farmers, and other interests that may sometimes compete with elk for forage and space. Biologically, a population that is managed around a M.O. is much larger than a minimum viable population. A minimal viable population represents the smallest population size that can persist over the long term. Historically there were game species, including elk, which warranted serious conservation concerns due to depressed populations and range contractions resulting from unregulated market and sport hunting and loss of habitat. Many of the factors that contributed to the decline of large wild ungulates in the past do not exist today. Currently, elk populations on the WWNF are regulated by hunting and predation. Elk numbers are substantially higher than what would constitute a concern over species viability.

Existing Condition

The Two Eagle project area falls within the Keating WMU (ODFW) contained within the Wallowa Province. Elk populations in the province increased in the 1970's to near the management objective of 5,000. This increase is thought to be due to increased forage production created by timber harvest, improved livestock management, and conservative antlerless harvest. From the 1980's to mid-1990s, the population stayed near the objective. After about 1995, the populations have declined. ODFW has recently decreased antlerless harvest in the two units that have contributed most significantly to the decline (Minam and Lookout Mountain).

The Forest Plan establishes standards for wildlife habitat, and more specifically elk habitat on the Forest. The Two Eagle analysis area provides year round habitat for big game, though no designated summer or winter range lies within the project area; 6346 acres is designated MA-1 (Intensive timber management) and covers the majority of the project area.

The Two Eagle project area was analyzed using a habitat effectiveness model (Thomas et al. 1988) to assess the quality of elk habitat. The HEI model evaluates size and spacing of cover and forage areas, density of open roads, quantity and quality of forage available to elk and cover quality. Forage data is unavailable and is not included in the total HEI value. To further examine security habitat for elk, a distance band analysis (DBA) was performed as described by Rowland et al. (2005), and a separate HEI value was calculated (Table 2). DBA calculates the percent of the analysis area from varying distances from open motorized routes. HEI was analyzed at the project level.

Cover: Forage Ratio – A cover: forage ratio is used to describe the relative amounts of cover to forage and while the optimal ratio of cover to forage is 40:60 (Thomas 1979), the LRMP establishes a minimum standard that at least 30% of forested land be maintained as cover (>40% canopy closure). Cover refers to any combination of satisfactory cover (a stand of coniferous trees with >70% canopy closure) and marginal cover (a stand of coniferous trees with 40-70% canopy closure). Forage habitat has less than 40% canopy cover.

The existing cover: forage ratio is 62.5:37.5. This ratio exceeds the LRMP standard, suggesting a high surplus of cover, however stand data was collected in the early 80's and the ratio may misrepresent the analysis area based on changed conditions due to natural disturbances over time.

Cover Quality – Forest stands with relatively closed canopies function as thermal and security cover, providing a visual barrier from predators, and may reduce the effects of ambient temperature, wind, and long and short wave radiation functions on energy expenditure (i.e. increased metabolic rates) in elk. Although the benefits to elk of "thermal cover", in the true sense of the word, has been questioned (Cook et al. 1998, Bender and Cook 2005), the intent of the standard in managing elk habitat remains credible in that habitat attributes can be influential to energy balances by affecting forage quality and quantity, and mediating energy expenditures associated with travel and harassment (Bender and Cook 2005). By implementing the current "thermal cover" standard, resource managers are providing barriers to minimize the negative effects of human disturbance.

There are currently 2,979 acres (36%) of satisfactory cover, 2,166 acres (26%) of marginal cover and 3,085 acres (38%) of forage habitat within the analysis area resulting in a cover quality value of 0.79 (Table 2).

Size and Spacing – Thomas et al. (1979) suggest that size and spacing of cover and forage habitat is a key to elk use of forested habitat, and this assumption was verified by Leckenby (1984) in the Blue Mountains of northeastern Oregon. Size and spacing of habitat is considered optimal when cover to forage edge widths are between 100-200 yards (Thomas et al. 1988). Considering an HE value of 1 is optimal, an HE size and spacing value of 0.69 (Table 2) indicates that forage to cover ratios within the analysis area is less than optimal, but acceptable.

Open Roads – Excessive open road densities have deleterious effects on habitat effectiveness by taking land out of production (1 road mile equals 4 acres of land), reducing the effectiveness of cover and increasing disturbance to elk. The existing average open road density within the Two Eagle analysis area

is 2.93 mi/mi² (Table 2). 6346 acres is designated MA-1 (Intensive timber management) and covers the majority of the project area and the average open road density is higher than the forest plan guideline of 2.5mi/mi² for MA-1. This road density estimate does not take into account off-road vehicle use on OHV trails, cross-country travel and on closed roads. When these variables are taken into account, road density estimates are likely to be higher. The Two Eagle project area borders the Eagle Cap wilderness, which can be considered high quality security habitat. The proximity of this large area of security could mitigate some negative disturbance effects caused by roads.

An important finding from the Starkey Experimental Forest and Range studies is that road (or route) density is not the best predictor of habitat effectiveness for elk. Instead, a method using distance bands proved to be a more useful tool for assessing effects from roads. Road densities do not provide a spatial depiction of how roads are distributed on the landscape (Rowland 2005), but a distance band analysis does. A distance band analysis uses GIS to draw concentric bands around motor vehicle routes until the entire area of interest (in this case the Two Eagle analysis area) is occupied by these bands. The distance band closest to motor vehicle routes (within one half mile) provides the least security for elk. As a result, elk choose to spend less time within one half mile of motor vehicle routes. As distance from motor vehicle routes increases, so does habitat effectiveness for elk. Elk find more security from human disturbance further from motor vehicle routes. The second distance band occupies the area between one-half and one mile from motor vehicle routes, and represents moderate quality security habitat for elk. For this analysis, the percentage of the landscape within each distance band was used as a means of comparing alternatives with regard to the effects of motor vehicle disturbance to elk.

Habitat Effectiveness Index – The Habitat Effectiveness Index (HEI) values are based on a comprehensive elk habitat model developed by Thomas et al. (1988). These values consider the interaction of size and spacing of cover and forage areas, density of roads open to vehicular traffic, forage quantity and quality, and the quality of cover. For this report, HEI values were calculated without a forage quality value because accurate forage data is not available. Roads often compromise the effectiveness of cover. The Forest Plan establishes minimum standards for the overall index. In addition, the Forest Plan establishes minimum standards for retention of total cover and open road density. Excessive open road densities have deleterious effects on habitat effectiveness by reducing the quality of security cover and increasing disturbance. These negative impacts change elk distribution and behavior. The impacts of OHV's on closed roads and cross country travel are not considered in an HEI analysis, although they likely cause some further reduction in habitat effectiveness. The existing values are 0.6 (road density analysis) and 0.59 (distance band analysis; Table 2).

Table 2. Habitat-effectiveness index calculations for elk habitat existing conditions within the Two Eagle analysis area

Habitat Effectiveness Variable	Habitat Effectiveness Value (Optimal = 1.0)	Comments
HE Cover	0.79	Amount of satisfactory cover relative to marginal cover
HE Size and Spacing	0.69	Mosaic of cover and forage, 64:36
HE r value using road density	0.4	Open road density 2.93 mi/mi sq LRMP MA-1 \leq 2.5 mi/mi sq

HEI value using distance bands	0.35	Concentric bands around open roads
Total HEI using road density ¹	0.60	LRMP MA-1 \geq 0.5 HEI
Total HEI using distance band analysis*	0.59	LRMP MA-1 \geq 0.5 HEI
Percent of area \geq 0.5 mi from open motorized route	1%	Security habitat

¹ HEI calculations do not include a forage variable because current, reliable forage data are not available

Direct/Indirect Effects for Rocky Mountain Elk

ALTERNATIVE 1 (No action)

There will be no direct or indirect adverse effects to elk cover and forage from alternative 1 because no timber harvest, fuels treatments, or transportation activities will occur. The no action alternative would maintain current conditions for elk habitat in the short-term (0-20 years). How elk habitat changes in the mid to long-term (beyond 20 years) would depend largely on the occurrence and scale of disturbances such as wildfire, and insect or disease epidemics, and changes in travel management and hunting. These events cannot be predicted with a reasonable level of certainty, but the risks associated with forgoing management actions can be described.

In the absence of restoring ponderosa pine and Douglas-fir on drier sites, and reducing grand fir through mechanical thinning, fuels reductions, and prescribed fire, cover will increase and forage will mature and lose palatability. Trees that are stressed from competition with adjacent trees will be more susceptible to insects and diseases. This could lead to decreases in cover as trees die and canopy closure decreases. Heavily stocked conifer stands will also decrease in canopy closure as self-pruning occurs, and tree crowns become more shallow and narrow from competition for space. In the absence of fire (prescribed or wildfire), forest fuels will build to a point that puts fire-resistant trees at risk. Large scale fire of uncharacteristic intensity would degrade elk habitat through a loss of cover, and through a reduction in edge habitat between cover and forage areas.

ALTERNATIVES 2, 2M, 3

Cover-Forage

All action alternatives would affect elk habitat. Existing conditions show a surplus of cover with forage being a limiting factor. All alternatives will reduce satisfactory and marginal cover (Table 3), but will improve the forage to cover arrangement. All action alternatives meet or exceed LRMP standards for percent cover. Forest stand tree density reductions from commercial treatments (thinning) with additional prescribed fire treatments would increase available elk forage. Post-treatment tree densities are expected to be variable, consisting of denser patches interspersed with more open areas, but generally commercial thinning will convert marginal cover to forage. The amounts of forage, marginal, and satisfactory cover remaining under each alternative does not reflect the finer scale mixture forage,

hiding cover, and small marginal cover patches that result from many intermediate commercial thinning prescriptions.

Table 3 - Summary of Cover Conversions by Action Alternatives (acres)

Indicators	Alternative 1	Alternative 2	Alternative 2M	Alternative 3
Satisfactory converted to marginal cover	0	562	562	503
Satisfactory cover converted to forage	0	74	74	68
Marginal cover converted to forage	0	554	554	320

Security

The HEI model developed by Thomas et al. 1998 relies on open road density as an indicator of relative effects from roads on elk habitat. More recent research in northeastern Oregon found that road density is a poor indicator of habitat effectiveness (Rowland et al. 2000). In contrast to Thomas et al. this study described a strong linear increase in elk use as the distance from roads increased. Therefore, a method using a distance banding approach, as described by Rowland et al. (2005) and Hillis et al. (1991) is utilized here as an alternate indicator of road effects on elk habitat in the Two Eagle project area (Table 4). Road closures are consistent across alternatives and will have a positive effect on elk security.

Table 4. Distance banding within Two Eagle project area

Distance Buffer(miles)	Existing Condition	Alternative 2	Alternative 2M	Alternative 3
0.5 mi (low security)	7,128	6,609	6,609	6,609
1.0 mi (moderate security)	79	583	583	583
1.5 mi (high security)	0	15	15	15

Cumulative Effects for Rocky Mountain Elk

Effects of past activities including road construction, fire suppression, prescribed fire, and timber management on WWNF lands have been incorporated into the existing condition. The current condition of elk habitat is largely a function of past management activities and historic large wildfires. Historically, the area was un-roaded, and forest stands were less dense and provided larger amounts of forage.

Cattle grazing will continue within the project area. The majority of range acres in the project area are grazed from June 1 – October 30. Resource partitioning between elk and cattle in northeastern Oregon was studied by Stewart et al. (2002). Elk utilized steeper slopes and higher elevations than cattle when cattle were present, possibly indicating competitive displacement of elk by cattle. Diet overlap between cattle and elk has been described, and is most prominent when forage resources are limited. However, most of the rangeland on NFS lands contained within the analysis area is in satisfactory condition.

Firewood cutting within this area may increase into additional areas due to the clearing and re-opening roads that have grown closed providing for increased disturbance from noise, vehicles, and people reducing security habitat during firewood season.

Conclusion

All action alternatives are consistent with LRMP standards and guidelines pertaining to elk. Treatments proposed under all action alternatives are expected to maintain or slightly improve elk habitat effectiveness, as indicated by HEI values, mostly due to an increase in forage and security availability. Proposed road closures across all alternatives will increase security habitat within the project area and will have a positive effect on distribution and escapement.

Old Growth Habitat: American Marten, Northern Goshawk, and Pileated Woodpecker

Introduction

The American marten, northern goshawk, and pileated woodpecker are MIS of old growth habitat (U.S. Forest Service 1990). Correct determination of the scale of analysis is the cornerstone of habitat analysis (Morrison et al. 2006). The choice of spatial scale must be based on the species' relationship with the landscape and should consider the scale at which to apply our results for management purposes (Morrison et al., 2006). Wildlife habitat is commonly analyzed at the watershed scale because it provides a systematic way to understand and organize ecosystem information and thus enhances the ability to estimate direct, indirect, and cumulative effects of management activities (Regional Interagency Executive Committee 1995). However, the watershed scale may be too fine to analyze viability for wide-ranging species' unless it can be placed within the broader context of how the watershed contributes to overall species viability (Regional Interagency Executive Committee 1995).

Impacts to old growth dependent MIS species within the Two Eagle project area were determined by analyzing effects to their habitat at several spatial scales starting with the project level then framing that within the context of the watershed and the Wallowa-Whitman National Forest. These scales take into account the species' relationship with the landscape as well as being practical for management purposes. MIS population viability assessments have been conducted for American marten, pileated woodpecker, and northern goshawk at the Blue Mountains and WWNF. These assessments are incorporated by reference within the existing condition and effects analysis for each species. For more in-depth information on the methodology behind these assessments, please refer to the full-length assessments in the project record and the associated peer-reviewed literature scales (Penninger and Keown 2011a, Penninger and Keown 2011b, Penninger and Keown 2011c).

The following describes the existing conditions and effects of the Two Eagle project on three old growth management indicator species:

- Section I – American Marten
- Section II – Northern Goshawk
- Section III – Pileated Woodpecker

I. American Marten (*Martes americana*)

Background information

Life history, risk factors, conservation status and population trend, as well as habitat condition and species viability are described in detail in the American Marten (*Martes americana*) Management Indicator Species Assessment, Wallowa-Whitman National Forest (Penninger and Keown 2011a). Portions of that assessment are summarized below.

The American marten (*Martes americana*, - hereafter marten) is associated with mature, mesic coniferous forests and is one of the most habitat-specialized mammals in North America (Bull and Heater 2001). Martens require complex physical structure in the forest understory created by lower branches of trees, shrubs and coarse woody debris (Buskirk and Ruggiero 1994, Witmer et al. 1998, Bull and Heater 2000). Marten in northeastern Oregon have been documented using large-diameter hollow trees and logs, accumulations of coarse woody debris, and trees with brooms for denning and resting sites (Bull and Heater 2000). 70% of martens in eastside mixed conifer forests used snags > 23.9 in DBH for denning and resting and downed wood > 20.7 in DBH for denning, resting and foraging (Mellen-Mclean et al. 2009).

Broad-Scale Habitat Assessments

Wales (2011) used Bayesian Belief Network (BBN) Models to conduct viability assessments for various wildlife species of interest at the Blue Mountains and WWNF scales, including American marten. Using a threshold of 60% canopy closure and minimum stand diameters of 20 inches in Cold Moist and Cold Dry Potential Vegetation Groups, Wales compared current habitat conditions to those estimated to have occurred historically. The threshold of >40% of the historical amount of source habitat in a watershed was used to identify watersheds with a relatively high amount of source habitat that would contribute to species viability. Watersheds that contain > 40% of the estimated historical median amount of source habitat (1,136 acres) are believed to provide for habitat distribution and connectivity, and better contribute to species viability across the Forest.

Historically, it is most probable (59% probability) that marten habitat was broadly distributed and of high abundance, and that marten were well distributed within the mixed conifer forests of the Blue Mountains and the WWNF. The abundance and distribution of habitat likely provided for a high degree of connectivity within the elevations and forest cover types that provided source habitat for martens (viability outcome A). Currently, marten habitat is more abundant in some parts of the Blue Mountains and less abundant in others, but less contiguous than historically. It is most probable (54% probability) that marten habitat is broadly distributed and of high abundance, but there are gaps where suitable environments are absent or only present in low abundance (viability outcome B).

At the regional scale (Blue Mountains), Wales (2011) found that source habitat amounts that occurred historically in the Blue Mountains totaled 277,715 acres. Source habitats within the Blue Mountains currently total 257,942 acres; or 93% of historical levels. On the WWNF, 144,347 acres of source habitat are estimated to have occurred historically. Currently the WWNF contains 129,943 acres of source habitat (90% of historical) (Penninger and Keown 2011a).

Like most coarse scale vegetation data sets, the one used in the viability assessment is imperfect. However, it indicates landscape patterns that reasonably estimate habitat conditions for marten at larger scales.

Existing Conditions

Eagle Creek

The Two Eagle project area lies within the Eagle Creek watershed. This watershed contains 10,367 existing acres of marten source habitat (habitat that can support a stable or increasing population of marten) out of 34,114 (30%) potential acres of marten habitat. The current watershed index is 2.19 with the historic watershed index at 2.42, indicating a high historic level of habitat quality and a current high level of habitat quality and quantity. This watershed currently provides $\geq 40\%$ of the median amount of source habitat that occurred historically, and is above the threshold necessary to support marten population viability (Penninger and Keown 2011a). The weighted index of this watershed is 9186, which indicates this watershed provides habitat of the quality, quantity, and distribution to support a self-sustaining and well distributed marten population.

Two Eagle Project Area

Primary source habitat for marten is defined as habitat within moist and cold upland forests in the LOS stage with $\geq 60\%$ canopy closure and $\geq 20"$ DBH as the tree size. According to a GIS query, the Two Eagle project area contains 1,407 acres of primary habitat, 20% of the project area. Remote sensing cameras were utilized in the summer of 2015 and 2016 in areas identified as marten habitat. Marten were detected on the northern, eastern and western boundaries of the project area, indicating use across the project area. Source habitat conditions are well distributed within the project area, primarily on north facing slopes in the areas of main stream tributaries including main eagle, west eagle, grove creek and glendenning creek.

Direct and Indirect Effects

Alternative 1

There will be no direct or indirect adverse effects to American marten from Alternative 1 because no timber harvest, fuels treatments, or transportation activities will occur. Existing marten source and secondary habitat would remain unchanged.

Alternatives 2, 2M and 3

In general, commercial treatments have the potential to affect marten habitat suitability by reducing stand canopy closures and understory tree densities and simplifying the structural complexity. This could expose marten to higher predation risk, reduce foraging opportunities and potential denning habitat. Habitat after a commercial treatment would not be expected to function as source habitat and

potentially not as foraging habitat in the medium term (0-40 years) before canopy cover increases heterogeneous structure returns. Commercial treatments proposed under alternative 2 and 2M would treat 281 acres and 319 acres (20% and 23% of existing) source habitat found within the project area (Table 5). The main difference between these two alternatives is a biomass component within Alt 2M. Though biomass treatments do not reduce canopy closure in the same way as other commercial treatments, more material would be removed than traditional fuels treatments, having a greater impact on source habitat. Alternative 3 proposes commercially treating 132 acres (9%) of marten source habitat.

Application of fuel treatments outside of stands proposed for timber harvest has the potential to reduce understory and down wood densities, but is unlikely to substantially reduce stand canopy closures. Katie Moriarty (2014) compared marten movement within open, simple stands treated with fuels treatments and untreated complex stands. She found that marten selected home ranges with a disproportionate amount of complex stands and avoided openings. Simple stands were marginally avoided compared to complex stands. Marten movement within simple stands vs. complex stands suggests that marten use simple stands for travel and for intermittent foraging but not for denning. Therefore, fuels treatments are expected to degrade, but not remove, marten habitat. Alternatives 2, 2M and 3 propose fuels treatments on 133 acres, 95 acres and 161 acres (9%, 7%, 11%) respectively (Table 5).

Table 5. Proposed Silvicultural Treatments in Modeled Marten Habitats

Habitat Type (Existing acres) on WWNF lands	Treatment Type by Alternative, Acres (Percent of Corresponding Habitat Type), Two Eagle Project Area					
	Alternative 2		Alternative 2M		Alternative 3	
	Comm.	Rx Fuel Only	Comm.	Rx Fuel Only	Comm.	Rx Fuel
Source Habitat (1,407 acres)	281 acres (20%)	133 acres (9%)	319 acres (23%)	95 acres (7%)	132 acres (9%)	161 acres (11%)

Marten Habitat at the Eagle Creek Watershed Level

Treatments under Alternative 2 and 2M would degrade about 4% of the source habitat available in the watershed and Alternative 3 would degrade about 2% of source habitat available in the watershed.

Post-treatment availability of source habitats would continue to exceed the threshold of 40% of the historical amount in the Eagle Creek watershed under all action alternatives, thereby continuing to contribute to species viability at the watershed scale. In addition, post-treatment amounts of source habitat as a percentage of potential habitat would be no less than 26%, well above the historic median of 16% described by Penninger and Keown (2011a).

Marten Habitat at the WWNF Scale

Estimated habitat impacts at the project area and watershed scales (described above) are based on source habitat parameters modeled according to Penninger and Keown (i.e. 50% canopy closure and 15 inch DBH criteria). Existing marten source habitat on the WWNF as modeled by Wales (2011a) totals 129,943 acres. As a result of proposed activities under the Two Eagle project, source habitats would be degraded a maximum of 414 acres under Alternatives 2 and 3. Because source and secondary habitats at the Forest level were modeled according to more conservative thresholds described by Wales (i.e. 60% canopy closure and 20 inch DBH criteria), it is reasonable to assume that the source habitat impacts

would actually be less than the estimate based on the 50% canopy closure and 15" DBH criteria. Therefore, source habitat impacts at the Forest level would equate to less than 0.003% across alternatives

Cluster analysis used to describe existing distribution of source habitats across the WWNF indicates that these habitats are well distributed across the Forest (Penninger and Keown 2011a). Post-treatment levels of source habitat under all Two Eagle action alternatives are expected to result in no change in the number of watersheds in Cluster W3 containing >40% source habitat that contribute to marten habitat distribution.

Landscape Permeability

Treatments proposed under each action alternative may decrease existing habitat permeability due to reduced canopy closure, decreased structural complexity, and increased disturbance on specified and temporary roads. Impacts from temporary roads are expected to be short-term (up to 10 years), with impacts scattered in time and space as treatments are implemented. Permeability reductions would be localized in the southern portion of the Eagle Creek watershed. Areas of higher permeability, located north of the project area, would remain unaltered by project activities.

Cumulative Effects

Past, present and reasonably foreseeable future actions were analyzed for cumulative impacts to the species. Effects of past activities including road construction, fire suppression, prescribed fire, and timber management on WWNF lands have been incorporated into the existing conditions for amounts and locations of marten habitats in the analysis areas and into the viability analysis.

Appendix D of the EA was reviewed for actions that might affect marten habitat within the Eagle Creek watershed. Cumulative impacts of ongoing and foreseeable actions are projected out to 20 years from the present. Ongoing and future livestock grazing is expected to have no effect on marten habitat because cattle tend to avoid areas with high amounts of down wood. On Forest Service lands within and outside the project area, firewood cutting will continue to reduce available snags and logs, but the effect is limited to areas adjacent to open roads. Timber harvest on private inholdings is expected to continue at some level, with anticipated reductions of trees larger than 10 inches DBH, but generally marten habitat does not occur on private inholdings in the Two Eagle project area.

Wales et al. (2011) estimated that approximately 144,300 acres of source habitat existed on the WWNF historically. At the time of the analysis, approximately 129,900 acres (90% of estimated historical conditions) of source habitat occurred on the WWNF. Since the viability assessment was run 15 Vegetation/Fuels Restoration projects have been analyzed across the Wallowa-Whitman. Some have been implemented and some are still undergoing the NEPA process, but are anticipated being implemented in the foreseeable future. These combined projects, including the Two Eagle Vegetation Management project, anticipate commercially impacting 2,746 acres of marten source habitat and non-commercially impacting 4,633 acres of marten source habitat. Taking these 7,379 acres of impacted source habitat into account, this results in approximately 122,521 acres (85% of estimated historical conditions) of source habitat existing on the WWNF. Cumulatively, vegetation management activities on the Wallowa-Whitman are not expected to change the viability outcome found by Wales et al. and marten source habitat will remain well distributed and highly abundant with some gaps where suitable environments are absent or only present in low abundance (viability outcome B).

Conclusion

Because this project impacts less than 0.003% of suitable habitat across the Forest, the overall direct, indirect and cumulative effects will result in a small negative effect to marten habitat. The decrease in habitat quality due to the Two Eagle Vegetation Management Project will be insignificant at the scale of the WWNF. The Two Eagle project may reduce habitat permeability at a localized scale, but impacts at the WWNF scale would be immeasurable. Post-treatment availability of source habitats would continue to exceed the threshold of 40% of the historical amount in the Eagle Creek watershed under all action alternatives, thereby continuing to contribute to habitat distribution and species viability on the WWNF.

II. Northern Goshawk

Background information

Life history, risk factors, conservation status and population trend, as well as habitat condition and species viability are described in detail in the Northern goshawk (*Accipiter gentilis*) Management Indicator Species Assessment, Wallowa-Whitman National Forest (Penninger and Keown 2011b). Portions of that assessment are summarized below.

The Northern goshawk (*Accipiter gentilis*, hereafter goshawk) was chosen as a supporting indicator of abundance and distribution of mature and old-growth forests (LRMP 1990). The goshawk is associated with dense canopied mixed conifer, white fir, and lodgepole pine associations (Wisdom et al. 2000). Important habitat attributes of goshawk prey species include snags, down logs, woody debris, large trees, openings, herbaceous and shrubby understories, and an intermixture of various forest structural stages (Wisdom et al. 2000). Goshawks are prey generalists and use open understories below the forest canopy and along small forest opening to forage for mammals and small birds (Bull and Hohman 1994, Marshall 1992, Squires 2000).

Goshawks use broad landscapes that incorporate multiple spatial scales to meet their life requisites (Squires and Kennedy 2006). At least three levels of habitat scale are recognized during the breeding season: (1) a nest area, composed of one or more forest stands or alternate nests; (2) a post fledging area (PFA), which is an area around the nest used by adults and young from the time of fledging, when the young are still dependent on the adults for food, to independence; (3) a foraging area that comprises the breeding pairs entire home range (Reynolds et al. 1992, Reynolds 1983).

The nest area, or nest site, is the area immediately surrounding the nest tree, including the forest stand containing the nest tree. In general, goshawk nest areas are unique in structure, with large trees, dense and multiple canopies, and high canopy closure (>50%) primarily within mature and older forests with high amounts of down wood and snags (Finn 1994, McGrath et al. 2003).

The post fledging area (PFA) surrounds the nest area and is defined as the area used by the family group from the time the young fledge until they are no longer dependent on the adults for food (up to two months) (Reynolds et al. 1992, Kennedy et al. 1994). PFAs generally have patches of dense trees, developed herbaceous and/or shrubby understories and habitat attributes (snags, down logs, small openings) that are critical for goshawk prey (Reynolds et al. 1992). The PFA is potentially important to

the persistence of goshawk populations, as it may correspond to the area defended by the breeding pair and provides fledgling hiding cover and foraging opportunities as fledglings learn to hunt.

Viability Determination

Throughout the Interior Columbia Basin, the amount of source habitat (i.e., habitat requirements to provide long term population persistence) available to the goshawk has declined from historical conditions. The greatest declines have occurred in the interior ponderosa pine and western larch forest types. It is estimated that there has been a 96% decline in old forest single-story ponderosa pine (Wisdom et al. 2000). However the interior Douglas-fir, grand fir, white fir, lodgepole pine, and juniper sagebrush have all increased in abundance from historical conditions. The overall decline in source habitat and strong decline in the ponderosa pine cover type is offset somewhat by increases in these other cover types and structural stages that provide source habitat.

Additional source habitat analysis was conducted at a finer scale on National Forest lands as part of a species viability assessment conducted in support of the Blue Mountains Forest Plan revision (Penninger and Keown 2011b). The current viability outcome index for the WWNF show that current source habitat for the goshawk is slightly lower than for the entire Blue Mountains but is very near historical conditions, indicating that suitable habitats are broadly distributed and of high abundance, and the goshawk is likely well-distributed throughout the WWNF (Penninger and Keown 2011b).

LRMP Standards and guidelines

The Regional Forester's Eastside Forest Plan Amendment #2 (SCREENS) requires that all known and historically used goshawk nest-sites be protected from disturbance. An active nest is defined as a nest that has been used by goshawks within the past five years. SCREENS requires that a 30-acre buffer of the most suitable nesting habitat be established around every known active and historical nest tree(s), that it be deferred from harvest, and that a 400-acre post fledging area be established around every known active nest site. While harvest activities can occur within the PFA, up to 60% of the area should be retained in LOS conditions and harvest is to promote the development of LOS. Management of the PFA is intended to provide a diversity of forest conditions. Thinning from below with irregular spacing of leave trees would maintain the appropriate stand composition and structure. A seasonal restriction on logging in the PFA would be implemented during the nesting season from March 1 – September 30.

Existing Conditions

Eagle Creek

The Two Eagle project area lies within the Eagle Creek watershed. This watershed contains 27,058 existing acres of goshawk source habitat (habitat that can support a stable or increasing population of goshawk) out of 67,380 (40%) potential acres of goshawk habitat. The current watershed index is 2.67 with the historic watershed index at 2.94, indicating a high historic level of habitat quality and a current high level of habitat quality and quantity. This watershed currently provides $\geq 40\%$ of the median amount of source habitat that occurred historically, and is above the threshold necessary to support goshawk population viability (Penninger and Keown 2011a). The weighted index of this watershed is 29,259, which, when compared to the index of other watershed, indicates this watershed provides habitat of the quality, quantity, and distribution to support a self-sustaining and well distributed goshawk population.

Two Eagle Project Area

Northern goshawk source habitat was assessed for the Two Eagle analysis area using four variables; potential vegetation group, canopy closure, number of canopy layers and tree size, as defined in the Northern Goshawk Management Indicator Species Assessment (Peninger and Keown 2011). Potential vegetation groups include dry ponderosa pine, dry Douglas-fir, dry grand fir, cool moist and cold dry. Canopy closure is generally greater than 40% in the dry vegetation types and greater than 60% in the cool and cold types. Canopy layers included both single and multi-story and tree size is defined as 15 in DBH or greater. A GIS query found 2,387 acres of primary northern goshawk habitat (33% of the project area). Audio callback transects were conducted June-August 2016 along transects in identified goshawk source habitat. No goshawks were encountered during surveys but goshawk encounters within the project area were reported to the wildlife biologist in 2017. Follow up surveys will be conducted in 2018 and when (if) a nest tree is identified, the proper treatment restrictions will be enforced (30 acres no treatment zone around nest tree).

Direct and Indirect Effects

Alternative 1 - No Action

There will be no direct adverse effects to old-growth associated MIS from the No Action Alternative because no timber harvest, fuels treatments, or transportation activities will occur. Existing source habitat would remain unchanged. However, the no-action alternative maintains possible unsustainable conditions in late-seral stage montane forests where there have been large transitions from shade-intolerant to shade-tolerant tree species, described as a management issue for Group 6 habitats by Wisdom et al. (2000).

Action Alternatives 2, 2M and 3

Two Eagle Project Area

Both timber harvest and fuels treatments within and outside timber harvest units would occur in northern goshawk source habitat under all action alternatives. Intermediate harvest treatments are expected to increase average stand diameter due to removal of trees primarily in smaller size classes, but across all size classes for Alternatives 2 and 3. Due to the possibility of snag removal during harvest and potential consumption of down logs during post-treatment underburning, treatments that retain sufficient canopy closures are still expected to degrade, but not remove, source habitat. Although some habitat elements may be reduced where habitat is degraded, sustainability of habitats is expected to increase as stand density reductions lower the risk of disturbance such as stand-replacement fire, especially in Dry Forest types. Table 6 shows acres and percent of source habitat proposed for treatment under each alternative.

Treatments proposed under Alternatives 2M would impact the greatest amount of goshawk source habitat. Harvest activities would occur within 584 acres of source habitat in Alternative 2, 699 in Alternative 2M and 503 acres in Alternative 3. These harvest activities could alter 21-29% of goshawk source habitat within the Two Eagle project area for approximately 20-30 years until canopy closure recovers and snags and logs begin to be recruited. Although the treated acres may no longer meet the definition of source habitat, they would still be available for goshawk foraging, roosting, and travel between other habitat patches. Fuel management activities (pre-commercial thinning, hand piling and

prescribed fire would occur within 254 acres of source habitat in Alternative 2, 139 acres in Alternative 2M and 273 acres in Alternative 3. Fuel management could reduce structural complexity in the understory in up to 11% of goshawk source habitat in the project area, but it will still meet the requirements for source habitat.

Table 6. Summary of Proposed Treatments in Goshawk Source Habitat

Habitat Type (Existing acres) on WWNF lands	Treatment Type by Alternative, Acres (Percent of Corresponding Habitat Type), Two Eagle Project Area					
	Alternative 2		Alternative 2M		Alternative 3	
	Comm.	Rx Fuel Only	Comm.	Rx Fuel Only	Comm.	Rx Fuel
Source Habitat (2,387 acres)	584 acres (24%)	254 acres (11%)	699 acres (29%)	139 acres (6%)	503 acres (21%)	274 acres (11%)

In addition to impacts to available habitats, each action alternative poses potential for direct impact to nesting individuals. Both timber harvest and prescribed fire could cause individual harm or mortality if operations destroy a nest tree occupied by young of the year. If goshawk nesting is discovered prior to, or during implementation, a no-activity nest area of at least 30 acres will be designated for active nests. Because goshawks were detected at locations during 2016 and 2017 surveys, and because the existing nest site was not confirmed with 100% certainty, additional goshawk surveys in these locations would occur prior to implementation of proposed silvicultural and fuels treatments.

Goshawk Habitat at the Watershed Level

Watershed indices reported by Wales (2011c) and further assessed by Penninger and Keown (2011c) for the existing condition showed that the Eagle Creek watershed currently contains a high amount of source habitat. Treatments proposed under Alternative 2 would reduce the amount of source habitat available in the watershed by approximately 2 percent. Source habitat would be reduced by 3% under Alternative 2A and by 2 percent under Alternative 3. Post-treatment availability of source habitats would continue to exceed the threshold of 40% of the historical amount in the Eagle Creek watershed under all action alternatives, thereby continuing to contribute to species viability at the watershed scale.

Goshawk Habitat at the WWNF Scale

Existing goshawk source habitat on the WWNF as modeled by Wales et al. 2011 totals 440,696 acres. As a result of projected habitat loss under the Two Eagle project, source habitats at the Forest-level would decline by less than 1 percent under all action alternatives.

Cluster analysis used to describe existing distribution of source habitats across the WWNF indicates that these habitats are well distributed across the Forest. Post-treatment levels of source habitat under all Two Eagle action alternatives result in no change in the number of watersheds in Cluster W3 containing >40% source habitat that contribute to goshawk habitat distribution.

Cumulative Effects

Cumulative effects for goshawk are analyzed for the Eagle Creek watershed. Past, present and reasonably foreseeable future actions were analyzed for cumulative impacts to the species. Effects of

past activities including road construction, fire suppression, prescribed fire, and timber management on WWNF lands have been incorporated into the existing conditions for amounts and locations of marten habitats in the analysis areas. Although some commercial treatments may occur within goshawk suitable habitat, the scale of potential impacts is not substantial in comparison to source habitats currently estimated to exceed 27,000 acres.

Appendix D of the EA was reviewed for actions that might affect goshawk habitat the Eagle Creek watershed. Ongoing and future livestock grazing is expected to have a minimal effect on suitable habitats. Additional grazing may occur in treated stands within the project area, but is not expected to alter suitable characteristics. On Forest Service lands within and outside the project area, firewood cutting will continue to reduce available snags and logs, but the effect is limited to areas adjacent to open roads. Access within the watershed and across the WWNF may change pending the outcome of the Forest Travel Management Plan. Timber harvest on private inholdings is expected to continue at some level, with anticipated reductions of trees larger than 10 inches DBH. Lands to the south of the project area will continue to consist of open grassland habitats in private ownership.

Wales et al. (2011) estimated that approximately 466,679 acres of source habitat existed on the WWNF historically. At the time of the analysis, approximately 440,696 acres (94% of estimated historical conditions) of source habitat occurred on the WWNF. Since the viability assessment was run 15 Vegetation/Fuels Restoration projects have been analyzed across the Wallowa-Whitman. Some have been implemented and some are still undergoing the NEPA process but are anticipated being implemented in the foreseeable future. These combined projects, including the Two Eagle Vegetation Management project, anticipate commercially impacting 7,222 acres of goshawk source habitat and non-commercially impacting 19,151 acres of goshawk source habitat. Taking these 26,373 acres of impacted source habitat into account there is approximately 440,306 acres (94% of estimated historical conditions) of source habitat existing on the WWNF. Cumulatively, vegetation management activities on the Wallowa-Whitman are not expected to change the viability outcome found by Wales et al. and goshawk source habitat will remain well distributed and highly abundant (viability outcome A).

Conclusion

Because this project impacts less than 1% of source habitat across the Forest, the overall direct, indirect and cumulative effects will result in a minimal negative effect to goshawk habitat. The loss of habitat will be insignificant at the scale of the WWNF. Post-treatment availability of source habitats would continue to exceed the threshold of 40% of the historical amount in the Eagle Creek watershed under all action alternatives, thereby continuing to contribute to habitat distribution and species viability on the WWNF.

III. Pileated Woodpecker

Background Information

Life history, risk factors, conservation status and population trend, as well as habitat condition and species viability are described in detail in the Pileated woodpecker (*Drycopus pileatus*) Management Indicator Species Assessment, Wallowa-Whitman National Forest (Penninger and Keown 2011c). Portions of that assessment are summarized below.

The pileated woodpecker (*Dryocopus pileatus*) occurs primarily in dense mixed-conifer forest in late seral stages or in deciduous tree stands in valley bottoms. It is occasionally seen in younger stands lacking large diameter trees, particularly in winter. It is rarely found in stands of pure ponderosa pine. The association with late seral stages stems from the need for large diameter snags or living trees with decay for nest and roost sites, large diameter trees and logs for foraging on ants and other arthropods, and a dense canopy to provide cover from predators (Marshall et al. 2003).

In northeast Oregon, the pileated woodpecker shows high selection for mature, unlogged grand fir stands with $\geq 60\%$ canopy closure, multiple canopy layers, and high snag density (Bull and Meslow 1988, Bull 1987, Bull and Holthausen 1993). Bull et al. (2007) found that densities of nesting pairs of pileated woodpeckers were positively associated with the amount of late structural stage forest and negatively associated with the amount of area dominated by ponderosa pine and the amount of area with regeneration harvest. Although there is a preference for dense canopy stands, high tree mortality and loss of canopy closure in stands of grand fir and Douglas-fir did not appear to be detrimental to pileated woodpecker provided that large dead or live trees and logs were abundant and that stands were not subject to extensive harvest. Pileated woodpecker densities remained steady over 30 years in areas where canopy cover dropped below 60% due to tree mortality; older stands of grand fir and Douglas-fir consisting primarily of snags continued to function as nesting, roosting and foraging habitat for pileated woodpeckers. While closed canopy forests were not essential for use by pileated woodpeckers, nest success was higher in home ranges that had greater amounts of forested habitat with $\geq 60\%$ canopy closure (Bull et al. 2007).

Pileated woodpeckers feed primarily on insects in dead wood in snags, logs, and naturally created stumps (Bull and Meslow 1988, Bull et al. 1986, Torgersen and Bull 1995). Based on research data compiled in the DecAID Wood Advisor (Mellen-Mclean et al. 2012) for eastside mixed conifer forests, 70% of pileated woodpeckers in the populations studied used snags > 12.9 in. DBH for foraging. Stands with high density of snags and logs were preferred for foraging (Bull and Meslow 1977).

Viability Determination

Habitat trends of the pileated woodpecker were assessed at the Interior Columbia Basin, Blue Mountains ecological reporting unit (ERU), and WWNF scales using information provided by Wisdom et al. (2000) and the species viability assessment conducted by Wales (2011) in support of the Blue Mountains Forest Plan revision.

A fine-scale analysis of source habitat on National Forest lands in the Blue Mountains, including the WWNF was conducted in 2011 (Penninger and Keown 2011c). This analysis indicated that there has been a decline in the amount of source habitat on the WWNF from historical conditions. However, source habitat of the pileated woodpecker is still available in adequate amounts and distribution to maintain pileated species viability on the WWNF. Currently, there are approximately 206,374 acres (57% of historical condition) of source habitat on the WWNF, with twenty-nine of the thirty-five watersheds (83%) on the WWNF that historically provided source habitat, continuing to provide that habitat. Reductions of snags and the presence of roads has decreased the quality of source habitat in many watersheds but 33% of the watersheds on the WWNF have high watershed index scores, indicating good habitat abundance, moderate to high snag densities and low to moderate road densities. Additionally, 29% of the watersheds are in the moderate category. Watersheds having $\geq 40\%$ of the median amount of source habitat are distributed across the WWNF and found in all clusters.

The viability assessment indicates the WWNF still provides for the viability of the pileated woodpecker. The pileated woodpecker is distributed across the WWNF and there are adequate amounts, quality, and distribution of habitat to provide for pileated woodpecker population viability.

Existing Condition

Eagle Creek

The Two Eagle project area lies within the Eagle Creek watershed. This watershed contains 18,569 existing acres of pileated source habitat (habitat that can support a stable or increasing population of pileated woodpeckers) out of 58,064 (32%) potential acres of pileated woodpecker habitat. The current watershed index is 2.27 with the historic watershed index at 2.63, indicating a high historic level of habitat quality and a current high level of habitat quality and quantity. This watershed currently provides $\geq 40\%$ of the median amount of source habitat that occurred historically, and is above the threshold necessary to support pileated woodpecker population viability (Penninger and Keown 2011a). The weighted index of this watershed is 17,033, which, when compared to other watershed indices, indicates this watershed provides habitat of the quality, quantity, and distribution to support a self-sustaining and well distributed pileated woodpecker population.

Two Eagle Project Area

Although pileated woodpeckers will use many habitat types, successful reproduction is thought to be tied to optimum habitat, which is typically Old Forest Multi Structure (OFMS). Pileated woodpecker source habitat was assessed for the Two Eagle analysis area using four variables; potential vegetation group, canopy closure, number of canopy layers and tree size, as defined by Penninger and Keown (2011). Potential vegetation groups include dry Douglas fir, dry grand fir, cool moist and cold dry. Canopy closure is generally greater than 40% in the dry vegetation types and greater than 60% in the cool and cold types. Canopy layers included both single and multi-story and tree size is defined as 20 in DBH or greater. Source habitat for pileated woodpeckers within the Two Eagle analysis area is approximately 1,604 acres, (22%) of the project area. Surveys during the 2016 and 2017 field season consistently found pileated signs in dry and moist OFMS stands.

LRMP standards and guidelines

The LRMP requires that a 300-acre pileated feeding area be established in proximity to any patch of MA15 ≥ 300 acres and that at least 2 snags > 10 in DBH/acre be maintained within the feeding area. The Regional Forester's Eastside Forest Plan Amendment #2 (SCREENS) requires the maintenance of snags and GTR trees > 21 in DBH at 100% potential population levels; at least 2.25 snags/acre are needed after post-sale activities are completed to meet the 100% level. The SCREENS require a higher density of snags compared to the LRMP and, therefore, designation of a 300-acre pileated feeding area as identified in the LRMP is exceeded by SCREENS directions.

Direct and Indirect Effects

Alternative 1

There will be no direct adverse effects to pileated woodpeckers from alternative 1 because no timber harvest, fuels treatments, or transportation activities will occur. Existing source habitat for pileated woodpeckers would remain unchanged. The no-action alternative maintains potentially unsustainable conditions in warm, dry LOS forests where there have been large transitions from shade-intolerant to shade-tolerant species. In the near-term, these denser forests with greater structural complexity may be highly attractive to pileateds. However, large uncharacteristic wildfires could eventually render pileated habitat unsuitable.

Alternatives 2, 2M and 3

Both timber harvest and prescribed fire treatments within and outside timber harvest units would occur in pileated woodpecker source habitat under all action alternatives. Thinning harvest treatments are expected to increase average stand diameter due to removal of trees primarily in smaller size classes, but across all size classes for Alternatives 2 and 3. Treatments that retain canopy closures that meet the definition of source habitat would remain as source habitat. However, due to the possibility of minor snag reductions for logging safety, and potential consumption of down logs and snags during post-treatment burning and in prescribed fire units, treatments that retain sufficient canopy closures are still expected to degrade, but still function as source habitat. Although some habitat elements may be reduced where habitat is degraded, sustainability of habitats is expected to increase as stand density reductions lower the risk of disturbance such as stand-replacement fire, especially in warm, dry forest types. Table 7 shows acres and percent of source habitat proposed for treatment under each alternative.

Table 7. Summary of Proposed Treatments in Pileated Source Habitat.

Habitat Type (Existing acres) on WWNF lands	Treatment Type by Alternative, Acres (Percent of Corresponding Habitat Type), Two Eagle Project Area					
	Alternative 2		Alternative 2M		Alternative 3	
	Comm.	Rx Fuel Only	Comm.	Rx Fuel Only	Comm.	Rx Fuel
Source Habitat (1,604 acres)	363 acres (23%)	160 acres (9%)	434 acres (27%)	89 acres (5%)	291 acres (18%)	182 acres (11%)

Treatments proposed under Alternative 2M would impact the largest amount of pileated source habitat. Harvest activities would occur within 363 acres of source habitat in alternative 2, 434 acres in Alternative 2M and 291 acres in Alternative 3. These harvest activities may alter 6-20% of pileated source habitat within the Two Eagle project area for approximately 20 years until canopy closure recovers and snags and logs begin to be recruited. Fuels activities would occur within 160 acres of source habitat in Alternative 2, 89 acres in 2M and 182 acres in Alternative 3. Fuels activity could reduce structural complexity in the understory of pileated source habitat but it will still meet the requirements for source habitat.

Retention of all snags except for safety concerns minimizes the potential for direct impacts to nesting pileated woodpeckers. In the long-term, accelerated tree growth due to lower stocking densities is

expected to develop large trees, and consequently large snags, at a faster rate than untreated areas. While long-term availability of total snag numbers may decrease, available snags will on average be larger in treatment units compared to untreated areas.

Activities that increase overall human presence and project-related noise levels, including system road reconstruction as well as timber harvest, may temporarily displace pileated woodpeckers locally in the short-term (i.e. during implementation), but are not expected to impact distribution or productivity within the project area in the long-term.

Pileated Woodpecker Habitat at the Watershed Level

Watershed indices reported by Wales (2011b) and further assessed by Penninger and Keown (2011b) for the existing condition showed that the Eagle Creek watershed contains a high amount of source habitat and a lesser amount of secondary habitat. Treatments proposed under Alternative 2, 2M and 3 would reduce the amount of source habitat available in the watershed by 2%, 2% and 1%, respectively.

Post-treatment availability of source habitats would continue to exceed threshold of 40% of the historical amount in the Eagle Creek watershed under all action alternatives, thereby continuing to contribute to species viability at the watershed scale.

Pileated Woodpecker Habitat at the WWNF Scale

Existing pileated woodpecker source habitat on the WWNF as modeled by Wales (2011b) totals 129,943 acres. As a result of projected habitat loss under the Two Eagle project, source habitats would decline by a maximum 434 acres. This results in a reduction in source habitat of 0.3% at the Forest level.

Cluster analysis used to describe existing distribution of source habitats across the WWNF indicates that these habitats are well distributed across the Forest (Penninger and Keown 2011b). Post-treatment levels of source habitat under all Two Eagle action alternatives result in no change in the number of watersheds in Cluster W3 containing >40% source habitat that contribute to pileated woodpecker habitat distribution.

Cumulative Effects

Past, present and reasonably foreseeable future actions were analyzed for cumulative impacts to the species. Effects of past activities including road construction, fire suppression, prescribed fire, and timber management on WWNF lands have been incorporated into the existing conditions for amounts and locations of source habitats in the analysis area.

Appendix D of the EA was reviewed for actions that might affect pileated habitat within the Eagle Creek watershed. Cumulative impacts of ongoing and foreseeable actions within the next 5 years from the present which overlap in time and space with the Two Eagle project and create a potentially measureable effect were considered. Ongoing and future livestock grazing is expected to have no effect on suitable habitats. Additional grazing may occur in treated stands within the project area, but is not expected to alter source habitats. On Forest Service lands within and outside the project area, firewood cutting will continue to reduce available snags and logs, but the effect is primarily limited to areas adjacent to open roads. Access within the watershed and across the WWNF will change when the Forest Travel Management Plan is implemented. Limiting public motor vehicle use to designated roads, trails and areas has the potential to reduce the miles of open roads where firewood gathering can reduce snags and logs. Timber harvest on private inholdings is expected to continue at some level, with

anticipated reductions of trees larger than 10 inches DBH. Lands to the south of the project area will continue to consist of open grassland habitats in private ownership.

Wales et al. (2011) estimated that approximately 359,608 acres of source habitat existed on the WWNF historically. At the time of the analysis, approximately 206,374 acres (57% of estimated historical conditions) of source habitat occurred on the WWNF. Since the viability assessment was run 15 Vegetation/Fuels Restoration projects have been analyzed across the Wallowa-Whitman. Some have been implemented and some are still undergoing the NEPA process, but are anticipated being implemented in the foreseeable future. These combined projects, including the Two Eagle Vegetation Management project, anticipate commercially impacting 3,454 acres of pileated source habitat and non-commercially impacting 10,039 acres of pileated source habitat. Taking these 13,493 acres of impacted source habitat into account, this results in approximately 192,881 acres (53% of estimated historical conditions) of source habitat existing on the WWNF. Cumulatively, vegetation management activities on the Wallowa-Whitman are not expected to change the viability outcome found by Wales et al. and pileated source habitat will remain distributed frequently as patches and in low abundance (Viability outcome C).

Conclusion

Because this project impacts less than 0.3% of suitable habitat across the Forest, the overall direct, indirect and cumulative effects will result in a small negative effect to pileated habitat. The reduction of habitat would be immeasurable at the WWNF scale. Post-treatment availability of source habitats would continue to exceed the threshold of 40% of the historical amount in the Eagle Creek watershed under all action alternatives, thereby continuing to contribute to habitat distribution and species viability on the WWNF.

Connectivity

The SCREENS provides direction for connectivity. Old growth stands are directed to be connected in a least two different directions by the shortest length, minimum 400 ft. wide corridor which maintains canopy cover in the upper one-third of the site potential. If this standard cannot be met, proposed treatments are dropped.

According to the SCREENS Forest Plan Amendment (U.S. Forest Service 1995), connectivity corridors do not necessarily meet the same description of "suitable" habitat for breeding for old growth species, but allows free movement between suitable breeding habitats. Identifying these connective corridors ensures that blocks of habitat maintain a high degree of connectivity between them, and do not become fragmented in the short-term. Connective corridors between patches of old growth structures have been identified on a map that is on file at La Grande Ranger District. These connective corridors are small blocks of land that attempt to provide connectivity between old-growth stands at a small scale.

Existing Conditions

Distribution of OFMS stands and MA15 areas, marten source habitat (due to its identified high canopy cover), slope, and aspect was used to identify watershed level landscape scale corridors and permeability (different from the fine-scale connective corridors between old-growth stands). These areas of connectivity span the Two Eagle project area in multiple spots and connect to the adjacent watersheds, most notably to the Eagle Cap wilderness that runs north of the project area. These corridors contain the majority of the old growth and MA15 found within the Two Eagle project area and

occur on north and north-east facing slopes with the assumption that these areas have the greatest potential for productivity and will contain the highest levels of canopy cover and multi-level complexity. These areas were built into the project design and none of the proposed treatments fragment these identified corridors. Proposed fuels treatments alongside these identified corridors can add protection to these more complex areas that would be removed from the landscape if a wildfire entered them.

Direct and Indirect Effects

Alternative 1

This alternative would have no direct effect on connectivity between LOS habitat patches. The current level of connectedness would persist, and would improve in quality in the absence of large scale disturbances. In the absence of silvicultural treatments that reduce tree stocking, the connective corridors will continue to increase in canopy closure and structural complexity. This condition in cold and moist upland forests can enhance connectivity for species like American marten. Conversely, dry upland forests are inherently less structurally complex than cold and moist upland forests. In the absence of silvicultural treatments to reduce tree stocking, these stands would continue to allow the establishment of shade tolerant grand fir, increased canopy closure, and increased stress to competition for resources. In the long-term (30+ years) these drier stands would be subjected to increased risks from wildfire, insects and diseases that will kill trees in numbers and distribution that could negatively affect connectivity between patches of single strata LOS habitat.

Alternatives 2, 2M and 3

Alternative 2, 2M and Alternative 3 would reduce the quality of connectivity corridors on 126 acres by reducing the canopy closure and structural complexity. Silvicultural prescriptions in connective corridor units would reduce competition between residual trees, increase tree growth rates, and increase trees' ability to defend against insects and diseases, while retaining levels of canopy closure and structural complexity to facilitate movement of wildlife between old-growth habitat patches.

Cumulative Effects

Alternative 1

The no action alternative will not contribute to the cumulative effects of past, present and foreseeable future activities. Any effects of forgoing silvicultural treatments and prescribed burning would occur later in time, and are addressed as indirect effects above.

Alternatives 2, 2M and 3

There is no difference between alternatives in effects to connectivity corridors. It is unknown whether the level of treatments in Alternatives would compromise connectivity to a level that leads to isolation or fragmentation of wildlife habitat. However, the riparian habitat conservation area network, M15 areas, wild and scenic river corridor (Eagle Creek), and the remaining forest matrix would combine to facilitate varying degrees of connectivity between distant LOS habitat patches.

The incremental effects of prescribed burning, non-commercial thinning, and mechanical fuels reduction, would be immeasurable relative to the quality and function of connective corridors.

Snag and Log Habitat: Primary Cavity Excavators (PCEs)

Background information

More than 80 species of wildlife use snags and living trees with defects (deformed limbs or bole, decay, hollow, or trees with brooms) in the interior Columbia River basin (Bull et al. 1997). The Blue Mountains of Oregon have 39 bird and 23 mammal species that use snags for nesting or shelter (Thomas 1979). The abundance of cavity-using species is directly related to the presence or absence of suitable cavity trees. Habitat suitability for cavity-users is influenced by the size (diameter and height), abundance, density, distribution, species, and decay characteristics of the snags. In addition, the structural condition of surrounding vegetation determines foraging opportunities (Rose et al. 2001). Not every stage of the snag's demise is utilized by the same species, but rather a whole array of species use the snag at various stages or conditions. Uses of snags include nesting, roosting, foraging, perching, courtship, drumming, and hibernating.

The Forest Plan identifies 15 primary cavity excavators as management indicator species (MIS) for the availability and quality of dead and defective wood habitat: northern flicker; black-backed, downy, hairy, Lewis', three-toed, and white-headed woodpeckers; red-naped and Williamson's sapsuckers; black-capped, chestnut-backed, and mountain chickadees; and pygmy, red-breasted, and white-breasted nuthatches.

Because these MIS were selected to represent dead and defective wood habitat, this analysis and discussion focuses primarily on that habitat component. Additional information on cavity-excavating birds' habitat associations, distribution and life history requirements is summarized in Mellen-McLean (2012a). A key assumption is if habitat is provided for PCEs, then habitat requirements for secondary cavity users will be met. Suitable nest sites are often considered the limiting factor for cavity nesting bird populations. Habitat for the white-headed woodpecker, and other species such as western bluebirds, was once quite common on the east side of the Cascade Mountains, but years of fire exclusion, along with selectively harvesting large old pine trees has greatly reduced this habitat to well below historic levels. Black-backed woodpecker habitats, consisting of a range of green and burned forest condition, have also decreased at the regional level due to past timber harvest, firewood removal, and fire suppression. The highest regional increase is shown for three-toed woodpecker, which is associated with late seral subalpine and montane conifer. In general, populations of cavity nesting birds have declined across the Blue Mountains compared to historical conditions, primarily due to reductions in the numbers of large snags (Wisdom, Holthausen et al. 2000)

Table 8. Conservation status of cavity-nesting MIS

Species	USFS Sensitive	USFWS Birds of Conservation Concern	ODFW
Black-backed woodpecker			Vulnerable
Northern three-toed woodpecker			Vulnerable
Downy woodpecker			
Hairy woodpecker			
Northern flicker			
Lewis's woodpecker	Yes	BCR 9, BCR 10	Critical
White-headed woodpecker	Yes	BCR 9, BCR 10	Critical
Red-naped sapsucker			
Williamson's sapsucker		BCR 9, BCR 10	
Pygmy nuthatch			
Red-breasted nuthatch			
White-breasted nuthatch			
Black-capped chickadee			
Chestnut-backed chickadee			
Mountain chickadee			

LRMP standards

LRMP direction is to maintain snags and green tree replacement trees of ≥ 21 inches DBH, or whatever is the representative diameter of the overstory layer if it is < 21 inches DBH, at 100% potential population levels of primary cavity excavators (U.S. Forest Service 1995). The LRMP used information from Wildlife Habitats in Managed Forests (Thomas et al. 1979; at least 2.25 snags > 20 in DBH per acre) to establish minimum snag guidelines. The model Thomas et al. (1979) used to generate snag densities addressed snags for roosting and nesting, but did not consider snags for foraging, and was never scientifically validated. More recently, several studies have shown these snag densities are too low to meet the needs of many primary and secondary cavity users (Bull et al. 1997, Harrod et al. 1998, Korol et al. 2002). Consequently, the original standards for snags and down wood from Thomas et al. (1979) were replaced with the Regional Forester's Forest Plan Amendment #2 (U.S. Forest Service 1995). Bull et al. (1997) found the 2.25 snags/acre insufficient and that 4 snags/acre (2.8 are between 10-20 inches DBH and 1.2 are > 20 inches DBH) is more appropriate as a minimum density required by primary and secondary cavity users for roosting, nesting, and foraging needs. Harrod et al. (1998) determined a range of historic snag densities for dry eastside forests between 5.9-14.1 snags/acre (5-12 are between 10-20 inches DBH and 0.9 to 2.1 are > 20 inches DBH). Korol et al. (2002) determined that HRV for large snags (20 inches DBH) for dry eastside mixed conifer forest with a low intensity fire regime was 2.9 to 5.4 snags/acre.

Rose et al. (2001) report that results of monitoring indicates that the biological potential models are a flawed technique (page 602). New information about the ecology, dynamics, and management of decayed wood has been published since then, and the state of the knowledge continues to change. However, until the LRMP is amended to reflect the new science, 100% biological potential is the minimum number of snags that need to be maintained through the life of the stand rotation.

Direction from the Eastside Screens requires that pre-activity levels of logs be left unless those levels exceed those shown in Table 9. Live green trees of adequate size must also be retained to provide replacements for snags and logs through time. Generally green tree replacements (GTRs) need to be retained at a rate of 25 to 45 trees per acre, depending on biophysical group. Pre-activity levels of logs should also be left unless levels exceed amounts specified in Amendment #2 (U.S. Forest Service 1995). Larger blowdowns with intact tops and root wads are preferred to shorter sections of tree boles.

Table 9 - LRMP standards for down wood¹ (U.S. Forest Service 1995).

Stand type	Pieces/acre ¹	Piece length	Diameter small end	Linear ft/acre
Ponderosa Pine	3-6	> 6'	12"	40'
Mixed conifer	15-20	> 6'	12"	140'
Lodgepole Pine	15-20	> 8'	8"	260'

¹ The table converts to about 0.4, 1.7, and 3.3 tons/acre for ponderosa pine, mixed conifer, and lodgepole pine,

The Decayed Wood Advisor (DecAID)

Integration of the latest science is incorporated into this analysis using DecAID Advisor (version 3.0) (Mellen-McLean et al. 2017) which is an internet-based summary, synthesis, and integration (a "meta-analysis") of the best available science: published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgment and experience. In addition to data showing wildlife use of dead wood, DecAID also contains data showing amounts and sizes of dead wood across the landscape based on vegetation inventory data.

A distribution analysis (<http://www.fs.fed.us/r6/nr/wildlife/decaid-guide/distribution-analysis-green-tree.shtml>) was used to determine how close current conditions for dead wood on the landscape match reference conditions. Existing conditions for dead wood were derived by using Gradient Nearest Neighbor (GNN) data (LEMMA). GNN produces pixel-based maps with associated snags. These maps provide the direct data necessary to construct "current situation" histograms. GNN uses the same data that were used to develop the distribution histograms for DecAID. For more information see [Ohmann and Gregory \(2002\)](#), and go to the following web site: <http://www.fsl.orst.edu/lemma/main.php?project=imap&id=home>.

The analysis area for the distribution analysis is larger than the project area and encompasses the Eagle Creek Watershed. The larger analysis area was needed to meet the minimum analysis area size of 12,800 acres per wildlife habitat type recommended by the authors of DecAID (Mellen-McLean et al. 2012).

The distribution analysis results are then compared to the needs of woodpecker species using tolerance levels and intervals (range between 2 tolerance levels) from DecAID. A tolerance interval is similar to the more commonly used confidence interval but with a key difference: tolerance intervals are estimates of

the percent of all *individuals* in the population that are within some specified range of values. In comparison, confidence intervals are estimates of *sample means* from the population of interest. For more information see "What is a Tolerance Level?"

(<http://www.fs.fed.us/r6/nr/wildlife/decaid/pages/What-is-a-tolerance-level.html>) and [Marcot et al. 2010](#).

An example of use of a tolerance level is as follows. If the 50% tolerance level for snag density at pileated woodpecker nest sites in a specific wildlife habitat type is 7.8 snags/acre, the interpretation would be that 50% of nest sites used by pileated woodpeckers in that habitat have < 7.8 snags/acre and 50% of nest sites used by pileated woodpeckers have > 7.8 snags/acre.

Existing Conditions of Dead and Defective Habitat

The Eastside Mixed Conifer (EMC) and Moist Mixed Conifer (MMC) wildlife habitat types (WHT) occur in the analysis area. Results of the DecAID distribution analysis are displayed in Figure(s) 1-4. Tolerance levels for woodpeckers are displayed in Tables 10 and 11.

Interpretation for EMC WHT

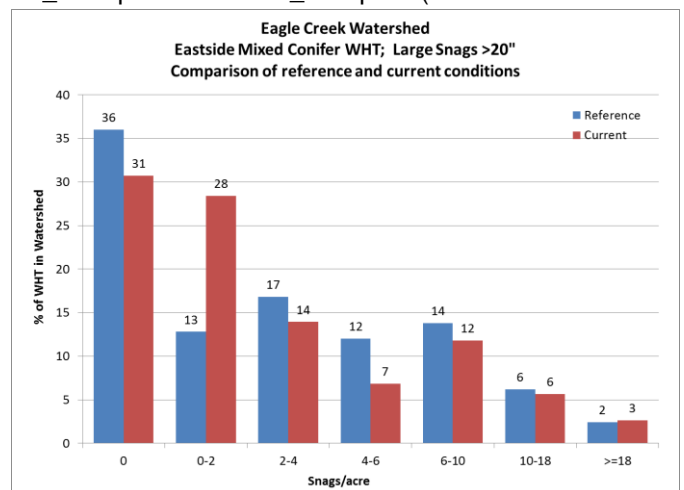
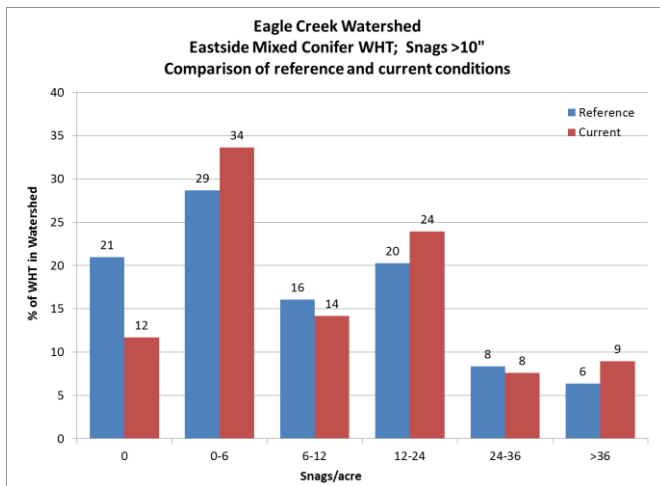
In the Eastside Mixed Conifer Wildlife Habitat Type (WHT), the landscape is deficient in snags density classes above 2 per acre for large (> 20" DBH) snags, as compared to reference conditions (Figure 2). Snag habitat for cavity-nesting birds is generally below reference conditions for densities of both large (>20") and small (>10") snags as more area is within the snag density class of 0 snags/acre than would be expected. In the higher density classes, especially the highest density classes, the area is currently below reference condition (figure 2A, B). These snag density classes (in deficit) provide habitat above the 30% tolerance level for pileated woodpecker and Williamson's sapsucker. Large snag habitat for those two species may be limiting in this WHT and the 2 woodpeckers may be limited to more productive sites in this WHT where snag densities are expected to be higher ((Bull et al. 2007), (Ohmann and Waddell 2002)). The amount of the landscape in the highest density classes for snags from unharvested stands (DecAID data) may be somewhat inflated due to an excess of dense stands with smaller trees susceptible to mortality than likely occurred historically. In addition, the data used in the calculation of reference conditions are from the late 1990s when spruce budworms were active in the Blue Mountains which created high levels of tree mortality.

In 2015, the Eagle Fire burned approximately 8,796 acres of National Forest System managed lands to the east of the Two Eagle project area within the Eagle Creek watershed. The majority (95%) of the affected area burned at low or moderate severity. Of those acres 3,444 acres were within the Eastside Mixed Conifer (EMC) habitat type.

Analysis using a historic range of variability specific to the analysis area and weighted by the amount of each habitat type suggest that the Eagle fire has created high-density snag habitat that is above the natural range of variation in the analysis area. Within the EMC habitat type, 24% of the area currently has snag densities in excess of 12 snags/acre, compared to 24% historically (Figure 1). The Eagle fire caused a dramatic, short-term increase in snag numbers. Snag habitat occurring within the fire area is

serving as intermittent habitat for most cavity excavators (Saab et al. 2004). The process of tree mortality and snag recruitment are balanced by the processes of snag decay and fall (Everett et al. 1999). Dahms (1949) found that 10 years post-fire, 50% of fire killed ponderosa pine snags remained standing but this declined to 22% standing after 22 years. It is estimated that about 75% of all snags may fall within 20 years (Keen 1929, Dahms 1949, Parks et al. 1999, and Everett et al. 1999). The effect of the Eagle fire is an immediate increase in snag habitat followed by a reduction in available habitat and a decrease in local populations as snags fall.

Figure 1-2 - Comparison of reference condition to current condition for snag density classes in the EMC WHT portion of the Two Eagle Analysis Area. Figure 1 displays snags > 20" DBH; Figure 2 displays snags > 10" DBH. 50% tolerance levels for wildlife species are displayed on both figures. Reference condition derived from DecAID unharvested vegetation plots in the Blue Mountains (see analysis file); wildlife tolerance levels for green stands and post-fire habitat from Tables EMC_S/L.sp-22 and EMC_PF.sp-22 (Mellen-



McLean et al. 2012).

Table 10 - Tolerance levels for woodpeckers occurring in the EMC Wildlife Habitat Type (From DecAID Tables EMC_S/L.sp-22 and EMC_PF.sp-22)

Species	Snag density/acre for 30%, 50%, 80% tolerance levels	
	>10" DBH	>20" DBH
White headed woodpecker	0.3, 3.9, 11.9	0.5, 1.8, 3.8
Pygmy nuthatch	1.1, 5.6, 12.1	
Black-backed woodpecker	2.5, 13.6, 29.2	0.0, 1.4, 5.7
Williamson's sapsucker	14.0, 28.4, 49.7	3.0, 8.4, 16.3
Pileated woodpecker	14.9, 30.1, 49.3	3.3, 8.6, 16.6

Interpretation for MMC WHT

In the Montane Mixed Conifer Wildlife Habitat Type (MMC WHT), the landscape has become deficient in large snags (>20") at the 4-6 snags/acre and the 10-18 snags/acre density class (Figure 3), though is above reference conditions at the 0-2, 2-4 and 6-10 density class. Conversely, the landscape contains excess small snags (>10") in the 6-12 snags/acre density class and up (Figure 4). This is likely due to fires that have burned in the landscape over the last decade creating areas with high densities of small snags. This portion of the landscape is providing habitat for those woodpeckers associated with post-disturbance habitats.

Figure 3-4 - Comparison of reference conditions to current condition for snag density classes in the MMC WHT portion of the Two Eagle Analysis Area. Figure 3 displays snags > 20" DBH; figure 4 displays snags > 10" DBH. Reference condition derived from DecAID unharvested vegetation plots in the Blue Mountains (see analysis file). Current conditions from GNN data (see analysis file)

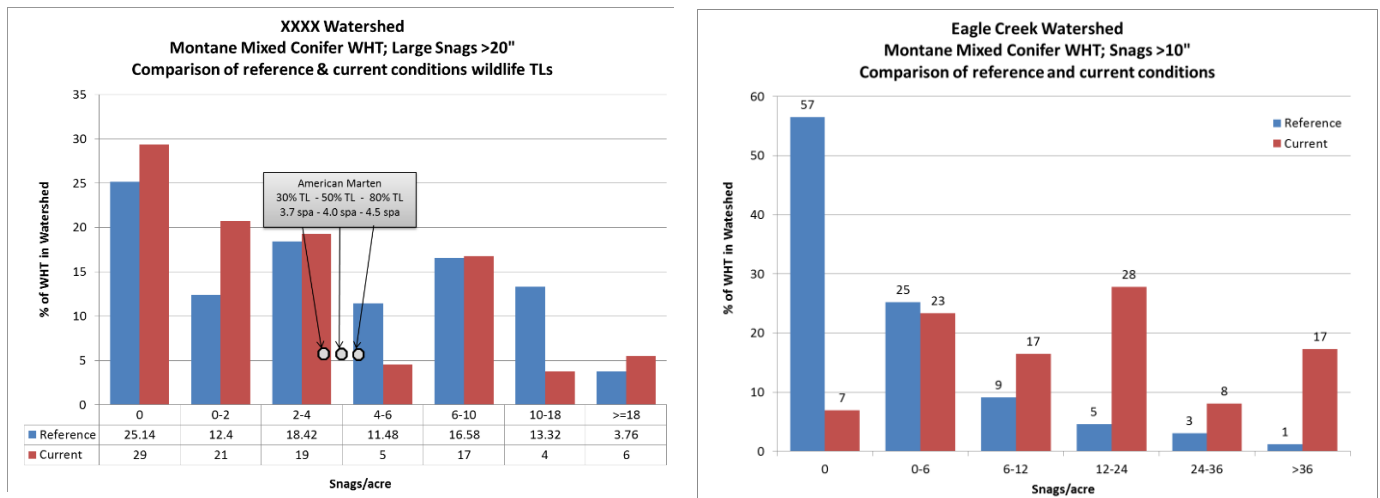


Table 11 - Tolerance levels for woodpeckers occurring in the MMC Wildlife Habitat (From DecAID Tables MMC_S/L.sp-22 and MMC_PF.sp-22)

Species	Snag density/acre for 30%, 50%, 80% tolerance levels	
	Green Forests	Recent Post-fire, >3" DBH
Black-backed woodpecker		41.6, 78.9, 134.0
Northern three-toed woodpecker		44.2, 71.5, 111.8
Williamson's sapsucker		10.8, 28.0, 51.8

Direct/Indirect Effects – Snag and Log Habitat

ALTERNATIVE 1

This alternative retains the most snag habitat in the short-term and mid-term to the degree that snags would not be reduced for operational reasons, or consumed during prescribed burning as in the action alternatives.

Stands containing larger structure trees would continue to provide snag and down wood habitat to meet habitat requirements of primary cavity nesters at least through the short-term (15-25 years). In the absence of stand replacement fires, down wood levels would continue to increase. Stands within the analysis area that were logged in the early 1990s would begin to provide snag habitat in the long-term. Tree mortality in overstocked stands will increase fuel loadings, increasing the likelihood of stand replacement fires. This would benefit species like black-backed and hairy woodpeckers in the short term, but would reduce or eliminate habitat for pileated, white-headed, and downy woodpeckers less associated with fire.

ACTION ALTERNATIVES

Non-commercial

Project activities will not remove any snags >12 inches except when they pose a danger to personnel. Non-commercial fuels treatments are not expected to negatively affect snag densities; though in the long-term pre-commercial thinning is expected to provide larger snags, similar to commercial thinning. Snags that are lost in prescribed burns are often replaced with new snags from trees killed during the fire. Proposed fuels activities (removing small trees, retaining large trees, prescribed burning) are expected to help create habitat for PCEs using open forests with large trees in the long-term and reduce habitat for those PCEs using dense forests.

Prescribed burning creates a period of reduced “soft snag” habitat that persists into the early mid-term. This can cause wildlife species that depend on such structures, such as pileated woodpeckers, to move to other areas in search of suitable habitat, resulting in lower productivity and reduced local populations. Although burning would likely reduce the densities of snags and logs, the burn plan is designed to protect large snags. The function of snag and log habitat in the analysis area is not likely to be compromised by burning given the considerations that are built into the prescription; the lighting pattern would be designed to protect large diameter snags. Fire would also likely create new snags and logs to replace some of the small to medium diameter material that may burn. However, newly created snags and logs are usually hard and not easily excavated. Burning creates a period of reduced “soft snag” habitat that persists into the short and early mid-term. This can cause wildlife species that depend on such structures to temporarily move to other areas in search of suitable habitat, resulting in lower productivity and reduced local populations. Alternatives 2, and 2M propose 5,105 and 4,961 acres of prescribed burning. Alternative 3 proposes 4,087 acres.

Commercial

Four different types of commercial treatments are proposed for the Two Eagle project area that are expected to affect future recruitment of snags. Models were run using the Forest Vegetation Simulator (FVS) looking at different treatments on different stands in the dry, moist and cold forest types to see the effects to snags comparing no treatment and treatment after 30 and 50 years.

All commercial treatments will reduce the density of snags on the landscape in the short and the long-term. Treatments are designed to improve the health of the stand, reducing competition, insect and disease mortality which in turn reduces snag recruitment. After 30 years a treated area has a range of 9-28 snags/acre as opposed to 16-76 snags/acre in an untreated area, and after 50 years a range of 7-35 snags/acre is found in treated areas compared to 20-70 snags/acre in untreated areas. These ranges in the treated areas still meet the minimum thresholds for primary cavity excavators (See Figures 1-4) and still meet forest plan standards for ecologically appropriate numbers. With treatment, snag size tends to be larger than without treatment. The average **DBH** of snags in treatment areas after 30 years is 11.2 inches as opposed to 8.8 inches **DBH**. Fifty years after treatment the average **DBH** in treated stands is 12 inches **DBH** compared to an average **DBH** of 10 inches in untreated stands. Treatments increase the growth rate of the remaining trees, thus increasing the amount of large trees in the mid to long-term, which will be beneficial to PCE's as large snags are limited on the landscape in all wildlife habitat types except Ponderosa Pine/Douglas-Fir.

Each Alternative proposes differing amounts of commercial treatment and non-commercial treatments (Table 12). Alternative 2M proposes the highest amount of commercial treatments, 26% of the project area. This alternative would have the highest short-term negative effect on the overall density of snags in the project area but long-term would provide the greatest positive effect on large snag recruitment. Alternative 3 proposes the least amount of commercial treatments, 16% of the project area. This Alternative would have the least short-term negative effect on the overall density of snags in the project area, but would also have the lowest positive effect on large snag recruitment. All alternatives would maintain snag levels above forest plan standards and provide habitat for PCE's at least at the 50% TL.

Table 12 - Comparison of proposed commercial and non-commercial treatments between Alternatives. Percentage is percent of project area

Treatments	Measure	Alternative 1	Alternative 2	Alternative 2M	Alternative 3
Commercial	Acres % Project Area	0	1,507 21%	1,869 26%	1,167 16%
Non-commercial	Acres % Project Area	0	1,026 14%	707 10%	905 13%
Total Commercial/ Non-Commercial	Acres % Project Area	0	2,533 36%	2,576 29%	2,072 35%
Prescribed Fire	Acres % Project Area	0	6,519 14%	6,369 13%	5,340 14%

Cumulative Effects on Snag and Log Habitat

The list of past, present and foreseeable actions was reviewed to determine potential effects to dead and defective wood habitat. Effects of past activities including road construction, fire suppression, prescribed fire, and timber management on WWNF and BLM lands have been incorporated into the existing condition. Firewood cutting will continue to reduce available snags and logs, but the effect is limited to areas adjacent to open roads. Roads that are temporarily open for harvest activities will temporarily increase firewood cutting activities and snag densities in those areas will go down, though it is illegal to take snags > 21 inch **DBH**. Precommercial thinning activities on adjacent private lands would not directly affect current snag levels but are expected to reduce future snag densities and increase average snag diameter while still maintaining Forest Plan snag standards. Timber harvest on private inholdings is expected to continue at some level, with anticipated reductions of trees larger than 10 inches **DBH** and snag densities are expected to decline.

Conclusion

Current availability of snags in the project area indicate deficiencies in large snag densities within the Eastside Mixed Conifer and Montane Mixed Conifer Wildlife Habitat Types, though habitat remains for all species at the 50% tolerance level. All proposed activities are consistent with Forest Plan and BLM Resource Management Plan standards and guidelines pertaining to primary cavity excavators. Timber harvest and prescribed burning under all action alternatives have the potential to decrease snag densities, but that impact is expected to be minor within the project area and on the landscape as a whole due to snag retention requirements.

Harvest treatments will result in lower levels of green tree recruitment, but recruitment levels meet Forest Plan standards as well as exceed recommendations from more recent research (Bull 1997, Harrod 1998, Korol 2002). Stand density treatments in conifer stands are expected to enhance habitats for, northern flicker, pygmy nuthatch, white-breasted nuthatch, and Williamson's sapsucker green tree habitats. Although treatments would improve habitats for these species within the project area, the effect to habitats Forest-wide would be minor considering that the project area encompasses only <1% of the WWNF acres. Proposed tree density reduction treatments would reduce risk to insect and wildfire disturbance on up to 2,533 acres within the project area, thereby reducing the potential for future pulses of habitat suitable for Lewis', hairy, and black backed woodpeckers within of the project area, although currently habitat exists within the watershed due to recent fires. No alternative considered for the Two Eagle project would affect population trends or viability for primary cavity excavator species at the Forest level.

Neotropical Migratory Bird Species

Background Information-

A migratory bird is defined by the Migratory Bird Treaty Act of 1918 as any species or family of birds that live, reproduce or migrate within or across international borders at some point during their annual life cycle. They are a large group of species, including many hawks (*Buteo sp.*), shorebirds (*Charadriiformes*), flycatchers (*Muscicapidae sp.*), vireos (*Vireonidae sp.*), swallows (*Hirundinidae sp.*), thrushes (*Turdidae sp.*), warblers (*Parulidae sp.*), and hummingbirds (*Trochilidae sp.*), with diverse habitat needs spanning nearly all successional stages of most plant community types. Nationwide declines in population trends

for migratory species, especially neotropical species, have developed into an international concern. Recent analyses of local and regional bird population counts, radar migration data, and capture data from banding stations show that forest-dwelling bird species, have experienced population declines in many areas of North America (Finch 1991). Habitat loss is considered the primary reason for declines. Other contributing factors include fragmentation of breeding grounds, deforestation of wintering habitat, and pesticide poisoning.

The U.S. Fish and Wildlife Service (FWS) is the lead federal agency for managing and conserving migratory birds in the United States; however under Executive Order (EO) 13186 all other federal agencies are charged with the conservation and protection of migratory birds. This Executive Order directs federal agencies to avoid or minimize the negative impact of their actions on migratory birds, and to take active steps to protect birds and their habitat. The order required federal agencies to develop Memorandum of Understandings (MOU) with the FWS to conserve birds including taking steps to restore and enhance habitat, prevent or abate pollution affecting birds, and incorporate migratory bird conservation into agency planning processes whenever possible.

In response to this, the Forest Service has implemented management guidelines that require the Forest Service to address the conservation of migratory bird habitat and populations when developing, amending, or revising management plans (Executive Order 13186, 2001). To aid in this effort, the USFWS published *Birds of Conservation Concern 2008 (BCC 2008)*. The overall goal of the report is to accurately identify the migratory (and non-migratory) bird species that represent the high conservation priorities. BCC 2008 uses current conservation assessment scores from three bird conservation plans: Partners in Flight North American Landbird Conservation Plan (PIF; Rosenberg et al. 2016), the United States Shorebird Conservation Plan (USSCP; Brown et al. 2001, USSCP 2004), and the North American Waterbird Conservation Plan (NAWCP, Kushlan et al. 2002).

Bird Conservation Regions (BCRs) are used to separate ecologically distinct regions in North American with similar bird communities, habitats, and resource management issues. Species contained within the BCC are identified for each BCR. The La Grande District and majority of the Wallowa-Whitman National Forest (WWNF) is found within BCR-10, Northern Rockies.

Existing Conditions

BCR-10 includes the Northern Rocky Mountains and outlying ranges in both the United States and Canada, and also the inter-montane Wyoming Basin and Fraser Basin. The Rockies are dominated by a variety of coniferous forest habitats. Drier areas are dominated by ponderosa pine, with Douglas-fir and lodgepole pine at higher elevations and Engelmann spruce and subalpine fir even higher. More mesic forests to the north and west are dominated by eastern larch, grand fir, western red cedar and western hemlock. In 2000, the Oregon-Washington Chapter of Partners in Flight published its Northern Rocky Mountains Bird Conservation Plan (Altman 2000). The plan provides conservation recommendations for the various species of landbirds that occupy the Oregon and Washington portions of the Interior Columbia Basin. For the Two Eagle project, dry forest, mesic forest, subalpine forest, montane shrubland and montane meadow habitat exist. No formal surveys have been conducted specifically for any of these species within the Two Eagle analysis area, although terrestrial birds were monitored in the Blue Mountains from 1994-2011 as part of the U.S. Forest Service Avian Monitoring Program (Huff and Brown 2006), as well as multiple annual breeding bird survey route through the La Grande and Baker districts (Sauer et al. 2011).

Table 14 - Migratory species of conservation concern identified within the Two Eagle analysis area

Focal Species	Key Habitat Relationships		
	Vegetative	Vegetation Structure	Special Considerations
Dry Forest			
Flammulated owl	Ponderosa pine, Douglas-fir	Old forest with grassy opening and dense thickets	Thicket patches for roosting; grassy openings for foraging
Moist Mixed Conifer Forest (late successional)			
Townsend's warbler	Grand fir, douglas-fir	High canopy cover and foliage volume	Sensitive to reduced canopy cover
Orange-crowned warbler	Douglas-fir	Dense shrub layer in forest openings and understory	Cowbird host; extensive grazing detrimental
Olive-sided flycatcher	Grand fir	Open conifer forests (<40% canopy cover) Edge and openings created by fire	Patches of mix of live and dead
Subalpine Forest			
Hermit thrush	Spruce-fir	Patches of subalpine forest with multi-layered structure and dense understory shrub layer	Livestock grazing can reduce understory density; species shows lower abundance in treated stands
Shrubland			
Calliope hummingbird	Montane shrubland	Montane shrublands at higher elevations where soils are more suitable for lower growing shrubby vegetation	Protect productive shrublands from encroaching trees
Willow flycatcher	Riparian Shrub	Riparian shrub dominated habitats, especially brushy/willow thickets	Restore riparian shrub habitat and increase width of riparian zone
Alpine Montane Meadows			
Lincoln's Sparrow	Apline montane meadows	Scattered or patchy shrubs/dense herbeaceous vegetation for nesting and foraging	Manage tree invasion at edge of meadows to maintain patch size and minimize effects on water table

Table 15- Impacts to habitat of migratory species of conservation concern within the Two Eagle analysis area

Species	Impacts to Habitat			
	No Action	Alt 2	Alt 2M	Alt 3
BIRDS OF CONSERVATION CONCERN (BCC)				
Flammulated owl	Potential source habitat would continue to be unsuitable due to high densities of small diameter trees.	Treatment within 394 acres of dry OFMS is expected to convert to OFSS and create habitat, by reducing densities of small diameter trees, encouraging the growth of larger trees and snags and creating heterogeneous openings of grassland.	Treatment within 394 acres of dry OFMS is expected to convert to OFSS and create habitat, by reducing densities of small diameter trees, encouraging the growth of larger trees and snags and creating heterogeneous openings of grassland.	Treatment within 384 acres of dry OFMS is expected to convert to OFSS and create habitat, by reducing densities of small diameter trees, encouraging the growth of larger trees and snags and creating heterogeneous openings of grassland.
Townsend's warbler	High density stands will continue to provide nesting and foraging habitat.	Commercial treatment proposed on 155 acres within moist late-successional forest will reduce existing >70 canopy cover, though all >21" DBH trees will remain. Habitat is expected to be unsuitable for the townsend's warbler until stand develops high canopy closure again.	Commercial treatment proposed on 155 acres within moist late-successional forest will reduce existing >70 canopy cover, though all >21" DBH trees will remain. Habitat is expected to be unsuitable for the townsend's warbler until stand develops high canopy closure again.	Commercial treatment proposed on 131 acres within moist late-successional forest will reduce existing >70 canopy cover, though all >21" DBH trees will remain. Habitat is expected to be unsuitable for the townsend's warbler until stand develops high canopy closure again.
Orange crowned warbler	Stands would continue to be unsuitable because of the lack of understory development until suppression mortality created gaps allowing for the development of understory layer.	Treatments will help restore habitats by removing encroaching, shade tolerant species and reducing dense and decadent overstocked habitats. 1,124 acres of treatments is proposed in mesic mixed conifer forests under Alt 2.	Treatments will help restore habitats by removing encroaching, shade tolerant species and reducing dense and decadent overstocked habitats. 1,124 acres of treatments is proposed in mesic mixed conifer forests under Alt 2M.	Treatments will help restore habitats by removing encroaching, shade tolerant species and reducing dense and decadent overstocked habitats. 905 acres of treatments is proposed in mesic mixed conifer forests under Alt 3.
Olive-sided Flycatcher (<i>Contopus cooperi</i>)	Suitable habitat condition would continue to be absent until suppression mortality created gaps and edge habitat.	Variable density thinning would create more diverse stand conditions and accelerates growth of larger trees that may become snags. Forest gaps would increase understory growth, contributing to increased insect production over the next 20 years. Increased forest edge habitat would also enhance foraging opportunities. Gaps created by thinnings may allow foraging until the canopy eventually closes again and these opportunities are lost.	Variable density thinning would create more diverse stand conditions and accelerates growth of larger trees that may become snags. Forest gaps would increase understory growth, contributing to increased insect production over the next 20 years. Increased forest edge habitat would also enhance foraging opportunities. Gaps created by thinnings may allow foraging until the canopy eventually closes again and these opportunities are lost.	Variable density thinning would create more diverse stand conditions and accelerates growth of larger trees that may become snags. Forest gaps would increase understory growth, contributing to increased insect production over the next 20 years. Increased forest edge habitat would also enhance foraging opportunities. Gaps created by thinnings may allow foraging until the canopy eventually closes again and these opportunities are lost.
Hermit thrush	Shrub component would continue to be lacking within areas of high subalpine and lodgepole density.	371 acres of potential habitat is proposed for treatment. Tree removal would create openings where shrub component for foraging and nesting could persist until the canopy cover increases and closes in 10 to 20 years.	395 acres of potential habitat is proposed for treatment. Tree removal would create openings where shrub component for foraging and nesting could persist until the canopy cover increases and closes in 10 to 20 years.	257 acres of potential habitat is proposed for treatment. Tree removal would create openings where shrub component for foraging and nesting could persist until the canopy cover increases and closes in 10 to 20 years.

Species	Impacts to Habitat			
	No Action	Alt 2	Alt 2M	Alt 3
Calliope hummingbird	Conifer encroachment within montane meadows would continue, precluding necessary shrub component from developing.	Conifer encroachment within montane meadows would continue, precluding necessary shrub component from developing.	Alpine meadow restoration treatments within Alt 2M would remove encroaching conifers on 27 acres from meadow habitat and encourage a shrub component.	Conifer encroachment within montane meadows would continue, precluding necessary shrub component from developing.
Willow flycatcher	Conifer encroachment within montane meadows would continue, precluding necessary shrub component from developing.	Conifer encroachment within montane meadows would continue, precluding necessary shrub component from developing.	Alpine meadow restoration treatments within Alt 2M would remove encroaching conifers on 27 acres from meadow habitat and encourage a shrub component.	Conifer encroachment within montane meadows would continue, precluding necessary shrub component from developing.
Lincolns sparrow	Conifer encroachment within montane meadows would continue, precluding necessary shrub component from developing.	Conifer encroachment within montane meadows would continue, precluding necessary shrub component from developing.	Alpine meadow restoration treatments within Alt 2M would remove encroaching conifers on 27 acres from meadow habitat and encourage a shrub component.	Conifer encroachment within montane meadows would continue, precluding necessary shrub component from developing.

Cumulative Effects for Neotropical Bird Species

Effects of past activities including road construction, fire suppression, prescribed fire, and timber management on WWNF lands have been incorporated into the existing condition. Livestock grazing is expected to continue within the analysis area. Habitat improvements afforded by the action alternatives for chipping sparrow may also increase access of areas to livestock and brown-headed cowbirds. The potential for increase in nest parasitism is expected to be most pronounced in areas adjacent to existing cattle operations and agriculture on private lands along the southern boundary of the project area.

Timber harvest on adjacent private lands is expected to continue, with little availability of late and old forest structure and large snags anticipated. Therefore, habitat on National Forest lands will be increasingly important as habitat on private lands is reduced.

Conclusion

All action alternatives have the potential to directly impact neotropical migratory bird species (NTMBs), due to potential nest tree removal during the nesting season. The level of impact is unknown, but potential is highest for Alternative 2M. The no-action alternative removes direct impacts to NTMBs but maintains habitat conditions that favor high-density forest stands that may not be sustainable in the long-term. Implementation of mitigation factors reduces the potential for direct impacts to nesting land birds.

The action alternatives increase dry forest habitats by restoring single-story structure, thereby benefiting land birds associated with this habitat type. Alternatives 2 and 2M would restore the largest amount of dry forest habitat.

All action alternatives would decrease available moist OFMS with >70% canopy cover with Alternative 2 and 2M removing the most and Alternative 3 less. All action alternatives have the potential to increase nest parasitism by opening up forest stands and increasing available forage for livestock.

Alternative 2M proposes meadow enhancement that could enhance foraging and nesting habitat for the Calliope hummingbird, the Willow flycatcher and the Lincolns sparrow. The other action alternatives forgo this treatment.

Unique Habitats- Meadow restoration for mule deer habitat enhancement

Mule deer (*Odocoileus hemionus hemionus*) populations throughout the western United States have experienced decades-long population fluctuations over the past century (Wallmo 1978, Unsworth et al. 1999) and Oregon is no exception (Ebert 1976, Peek et al. 2002). Mule deer populations in Oregon peaked at approximately 575,000 (Workman and Low 1976) in the 1960's but declined to nearly 255,000 by the early 2000's (Oregon Department of Fish and Wildlife [ODFW] 2003). From 2002–2015, mule deer populations in Oregon declined an additional 10% (ODFW, unpublished data). One compelling argument proposed to explain population declines of mule deer is that higher tree cover has a negative influence on mule deer nutrition and that increases of forest cover due to wildfire suppression and declining harvest in Oregon led to population declines (Covington et al. 1994, Peek et al. 2001, Peek et al. 2002). Mule deer occupy a variety of vegetative communities, including forests where understory biomass of well-developed shrubs and associated herbs is most abundant in early successional stages. However current management practices that prevent natural disturbances, such as fire, have reduced these early successional stage habitats. Factors such as low-quality diet during late spring and fawning have been shown to influence fawn survival (Salwasser 1979) indicating spring and early summer forage conditions have an influence on population dynamics.

According to the Oregon Department of Fish and Game (ODFW 2003), important deer habitats in Eastern Oregon are summer habitat, primarily occurring at higher elevations, including areas needed for reproductive activities. High quality summer habitat provides adequate forage to replace body reserves and includes areas specifically used for reproductive purposes. These areas must have an adequate amount of succulent vegetation and provide security from predators. Availability of forage is generally low within closed-canopy forests and high within early successional openings.

Alternative 2M within the Two Eagle project area proposes 27 acres of meadow habitat for mule deer restoration. These units have been identified by ODFW and USFS biologists as important summer and fawning habitat. Forested areas nearby provide good security and the meadow areas have the potential to provide nutritional opportunities. However, due to lack of disturbance, conifers have begun to encroach upon the meadow habitat and are shading out potential forbes and shrubs. Removing some of these trees would encourage the growth of highly nutritional species, enhancing the habitat for mule deer.

In addition to enhancing mule deer habitat, moving these meadow systems back to a more early seral condition can have positive effects for multiple species. The calliope hummingbird, a neotropical

migrant regularly breeds in meadow understories dominated by shrubs, including regrowth areas after logging (Calder and Calder 1994). The Lincoln's sparrow and the willow flycatcher, other neotropical migrants, are nesting obligates of open montane meadows (Ammon 1995.). Partners in Flight (Altman and Bresson 2017) recommends maintaining or promoting low canopy cover to enhance habitat for these species. Insect pollinator's abundance and species richness, a suite of species increasingly at risk due to habitat loss, introduced diseases and climate change, are strongly correlated with the abundance of floral resources which can be strongly influenced by canopy cover (Nyoka 2010). Increasing the floral resources within these meadow systems by removing encroaching conifers would have a positive effect on mule deer, neotropical migrants and pollinator species.

References

- Adamus, P.R., K. Larsen, G. Gillson, and C.R. Miller. 2001. Oregon Breeding Bird Atlas. Oregon Field Ornithologists, Eugene, OR. CD-ROM.
- Altman, B. 2000. Conservation strategy for landbirds in the northern Rocky Mountains of eastern Oregon and Washington, version 1.0. Oregon-Washington Partners in Flight. 128p.
- Altman, B. and B. Bresson. 2017. Conservation of landbirds and associated habitats and ecosystems in the Northern Rocky Mountains of Oregon and Washington. Version 2.0. Oregon-Washington Partners in Flight (www.orwapif.org) and American Birds Conservancy and U.S. Forest Service/Bureau of Land Management.
- Ammon, E.M. 1995. Lincoln's sparrow (*Melospiza lincolnii*). In A. Poole and F. Gill (editors), The Birds of North America, Number 135. The Birds of North America Incorporated, Philadelphia, PA.
- Aubry, K.B. and C.M. Raley. 2002. The pileated woodpecker as a keystone habitat modifier in the Pacific Northwest. In Laudenslayer, W.F., Jr., P.J. Shea, B.E. Valentine, C.P. Weatherspoon, and T.E. Lisle, tech. eds. 2002. Proceedings of the symposium on the ecology and management of dead wood in western forests. Gen. Tech. Rep. PSW-GTR-181. PSW Research Stn, USDA Forest Service. 949 p.
- Beal, Foster Ellenborough Lascelles. *Food of the woodpeckers of the United States*. No. 37. US Dept. of Agriculture, Biological Survey, 1911.
- Beckwith, Roy C., and Evelyn L. Bull. "Scat analysis of the arthropod component of pileated woodpecker diet." *The Murrelet* 66.3 (1985): 90-92.
- Boal, C. W., D. E. Andersen, and P. L. Kennedy. 2003. Home range and Residency Status of Northern Goshawks Breeding in Minnesota. *The Condor*, 105(4):811-816. 2003.
- Boal, C. W., and R. W. Mannan. "Northern goshawk diets in ponderosa pine forests on the Kaibab Plateau." *Studies in Avian Biology* 16 (1994): 97-102.

- Buchanan, J.B., R.E. Rogers, D.J. Pierce, and J.E. Jacobson. 2003. Nest-site habitat use by white-headed woodpeckers in the eastern Cascade Mountains. *Northwestern Naturalist* 84(3):119-128.
- Bull, E. L. 1987. Ecology of the Pileated Woodpecker in Northeastern Oregon. *J. Wildl. Manage.* 51(2):472-481.
- Bull, E. L. and R. S. Holthausen. 1993. Habitat Use and Management of Pileated Woodpeckers in Northeastern Oregon. *The Journal of Wildlife Management*, Vol. 57, No. 2 (Apr., 1993), pp. 335-345.
- Bull, E. L., and J. H. Hohman. 1994. Breeding biology of northern goshawks in northeastern Oregon. *Studies in Avian Biology* 16:103-105.
- Bull, E. L., D. G. Parks, and T. R. Torgersen. 1997. Trees and logs important to wildlife in the interior Columbia River Basin. Gen. Tech. Rep. PNW-GTR-391. USDA, Forest Service, Pacific Northwest Research Station. Portland, OR. 55p.
- Bull, E. L., N. Nielsen-Pincus, B. C. Wales, and J. L. Hayes. 2007. The Influence of Disturbance Events on Pileated Woodpeckers in Northeastern Oregon. *Forest Ecology and Management*: 243 (2007) 320-329.
- Bull, E. L., R. S. Holthausen, and M. G. Henjum. 1992. Roost Trees Used by Pileated Woodpeckers in Northeastern Oregon. *J. Wildl. Manage.* 56(4):786-793.
- Bull, E.L. and T.W. Heater. 2000. Resting and denning sites of American martens in northeastern Oregon. *Northwest Science* 74(3):179-185.
- Bull, E.L. and T.W. Heater. 2001. Home range and dispersal of the American marten in northeastern Oregon. *Northwestern Naturalist* 82: 7-11.
- Bull, E.L., A.A. Clark, and J.F. Shepherd. 2005. Short-term effects of fuel reduction on pileated woodpeckers in northeastern Oregon- a pilot study. Res. Pap. PNW-RP-564. Portland, OR. USDA Forest Service, Pacific Northwest Research Station. 17p.
- Bull, E.L., S.R. Peterson, and J.W. Thomas. 1986. Resource partitioning among woodpeckers in northeastern Oregon. Research Note PNW-444. USDA Forest Service, Pacific Northwest Research Station. 19p.
- Bull, E.L., T.W. Heater, and J.F. Shephard. 2005. Habitat Selection by the American Marten in Northeastern Oregon. *Northwest Science*. Vol. 79 No. 1:37-43.
- Buskirk, S.W. and R.A. Powell. 1994. Habitat ecology of American martens and fishers. In: Burkirk, S.W.; Harestad, A.; Raphael, M.; Powell, R.A., eds. *Martens, sables and fishers: biology and conservation*. Ithaca, NY: Cornell University Press: 283-296.
- Cahall, R.E. 2007. Influences of salvage logging on forest birds after fire in the eastern Cascades, Oregon. M.S. Thesis. Oregon State Univ., Corvallis. 132 pp.

- Cahall, R.E., and J.P. Hayes. 2008. Influences of postfire salvage logging on forest birds in the Eastern Cascades, Oregon, USA. *Forest Ecology and Management* 257:1119-1128.
- Calder W.A., and L.L. Calder. 1994. Calliope hummingbird (*Selasphorus calliope*). In A. Poole and F. Gill (editors), *The Birds of North America*, Number 135. The Birds of North America Incorporated, Philadelphia, PA.
- Camp, A., C. Oliver, P. Hessburg, and R. Everett. 1997. Predicting late-successional fire refugia pre-dating European settlement in the Wenatchee Mountains. *Forest Ecology and Management*. 95, 63-77.
- Countryman, B. 2010. Calculating fire regime condition class, fire frequency, and fire severity for the Blue Mountains Forest Plan Revision. Unpublished Report. 9p.
- Cook, John G., et al. "Nutrition-growth relations of elk calves during late summer and fall." *The Journal of wildlife management* (1996): 528-541.
- Covington, W.W., R.L. Everett, R.Steele, L.L. Irwin, T.A. Daer, A.N.D Auclair. 1994. Historical and anticipated changes in forest ecosystems of the Inland West. *Journal of Sustainable Forestry* 4:13-63.
- Crocker-Bedford, B.C . 1990. Goshawk reproduction and forest management. *Wildl. Soc. Bull*, 18:262-269.
- Csuti, B., A. J. Kimerling, T. A. O'Neil, M. M. Shaughnessy, E. P. Gaines, and M. M. P. Huso. 2001. *Atlas of Oregon wildlife: distribution, habitat, and natural history*. Oregon State University Press, Corvallis, OR. 492p.
- Dahms, W.G. 1949. How long do ponderosa pine snags stand? Research Notes, No. 57. Pacific Northwest Forest and Range Experiment Station. Deschutes Branch.
- Daw, K., and S . DeStefano. 2001. Forest Characteristics of Northern Goshawk Nest stands and Post-Fledging Areas in Oregon. *Journal of Wildlife Management*. Vol. 65, No. 1 (Jan. 2001), pp. 59-65.
- Desimone, Steven M. and Stephen DeStefano. 2005. Temporal patterns of northern goshawk nest area occupancy and habitat: a retrospective analysis. *Journal of Raptor Research* 39(3):310-323.
- Ebert, P. 1976. Recent changes in Oregon's mule deer population and management. *Proc. West. As-soc. Game and Fish Commissioners* 56:408-414.
- Erdman, T. C. "Goshawk nesting survey in northeast Wisconsin-1996." *Midwest Regional Raptor Management and Peregrine Symposium*. US Fish and Wildlife Service, Fort Snelling, Minnesota, and Milwaukee, Wisconsin. 1998.
- Everett, R., J. Lehmkuhl, R. Schellhaas, P. Ohlson, D. Keenum, H. Riesterer, and D. Spurbeck. 1999. Snag dynamics in a chronosequence of 26 wildfires on the east slope of the Cascade Range in Washington state, USA. *International Journal of Wildland Fire* 9(4): 223-234.

- Garrett, K.L., M.G. Raphael and R.D. Dixon. 1996. White-headed Woodpecker (*Picoides albolarvatus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/252>.
- Gecy, B. 2010. Climate change and potential climate effects on National Forest system lands in the Blue Mountains, northeast Oregon and southwest Washington. Part 1: Climate baseline. Unpublished Report. 36 p.
- Haggard, M. and W.L. Gaines. 2001. Effects of stand-replacement fire and salvage logging on a cavity-nesting bird community in eastern Cascades, Washington. *NW Science*. 75(4):387-396.
- Hargis, C.D., C. McCarthy, and R.D. Perloff. 1994. Home ranges and habitats of northern goshawks in eastern California. *Studies in Avian Biology* 16:66-75.
- Harrod, R.J., W.L. Gaines, W.E. Hartl, and A. Camp. 1998. Estimating historical snag density in dry forests east of the Cascade Range. Gen. Tech. Rep. PNW-GTR-428. USDA, Forest Service, Pacific Northwest Research Station. Portland, OR. 16p.
- Hejl, Sallie, Mary McFadzen, and Thomas Martin. 2000. Maintaining fire-associated bird species across forest landscapes in the northern Rockies. INT-99543-RJVA, Final Report. Rocky Mountain Research Station, Missoula, MT. 14 pp, plus 3 figures.
- Hobbs, N. T., D. L. Baker, J. E. Ellis, and D. M. Swift. 1981. Composition and quality of elk winter diets in Colorado. *Journal of Wildlife Management* 45(1):156-171.
- Horton, S.P. and R.W. Mannan. 1988. Effects of prescribed fire on snags and cavity-nesting birds in southeastern Arizona pine forests. *Wildlife Society Bulletin* 16(1):37-44.
- Hoyt, Sally F. "The ecology of the pileated woodpecker." *Ecology* 38.2 (1957): 246-256.
- Huff, M.H., and C.M. Raley. 1991. Regional patterns of diurnal breeding birds communities in Oregon and Washington. Pp. 177-205. IN. Ruggiero, Leonard F., Keith B. Aubry, Andrew B. Carey, and Mark H. Huff., tech. coords. Wildlife and vegetation of unmanaged Douglas-fir forests. USDA, Forest Service, PNW Research Station, PNW-GTR-285, Portland, OR.
- Keen, F.P. 1929. How soon do yellow pine snags fall? *Journal of Forestry* 27:735-737.
- Kennedy, P.L., J.M. Ward, G.A. Rinker, and J.A. Gessaman. 1994. Post-fledging areas in northern goshawk home ranges. *Studies in Avian Biology* 16:75-82.
- Korfhage, R.C., J.R. Nelson, and J.M. Skovlin. 1980. Diets of Rocky Mountain elk in northeastern Oregon. *Journal of Wildlife Management* 44(3):746-750.
- Korol, J.J., M.A. Hemstrom, W.J. Hann, and R. Gravenmier. 2002. Snags and down wood in the Interior Basin Ecosystem Management Project. *In* Proceedings of the symposium on the Ecology and

Management of Dead Wood. Gen. Tech. Rep. PSW-GTR-181. USDA, Forest Service, Pacific Southwest Research Station. 28p.

- Kreisel, K.J. and S.J. Stein. 1999. Bird use of burned and unburned coniferous forest during winter. *Wilson Bull.* 111:243-250.
- Li, P. and T.E. Martin. 1991. Nest-site selection and nesting success of cavity-nesting birds in high elevation forest drainages. *Auk* 108(2): 405-418.
- Mannan, R.W. and E.C. Meslow. 1984. Bird populations and vegetation characteristics in managed and old-growth forests, northeastern Oregon. *Journal of Wildlife Management* 48(4): 1219-1238.
- Marshall, B, M.G. Hunter, and A.L. Contreras, eds. 2003. *Birds of Oregon*. Oregon State University Press, Corvallis. 752p.
- Marshall, D. B. 1992. Status of the Northern Goshawk in Oregon and Washington. Audubon Society of Portland, Portland, OR. 35p.
- McGrath, M.T., S. DeStefano, R. A. Riggs, L. L. Irwin and G. J. Roloff. 2003. Spatially Explicit Influences on Northern Goshawk Nesting Habitat in the Interior Pacific Northwest. *Wildlife Monographs* No. 154:pp. 1-63.
- Mellen-McLean, Kim, Bruce G. Marcot, Janet L. Ohmann, Karen Waddell, Elizabeth A. Willhite, Steven A. Acker, Susan A. Livingston, Bruce B. Hostetler, Barbara S. Webb, and Barbara A. Garcia. 2017. DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 3.0. USDA Forest Service, Pacific Northwest Region and Pacific Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland, Oregon. https://apps.fs.usda.gov/r6_DecAID
- Moore, K.R. and C.J. Henny. 1983. Nest site characteristics of three coexisting *Accipiter* hawks in northeastern Oregon. *Raptor Research* 17(3): 65-76.
- NatureServe. 2010. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>.
- Nielsen-Pincus, N., and E.O. Garton. 2007. Responses of cavity-nesting birds to changes in available habitat reveal underlying determinants of nest selection. *Northwest Naturalist* 88:135-146.
- Nyoka, Susan E. 2010. Can restoration management improve habitat for insect pollinators in Ponderosa Pine forests of the American Southwest? *Ecological Restoration* 28: 280- 290.
- Oregon Department of Fish and Wildlife. 2003. Oregon's mule deer management plan. Oregon Department of Fish and Wildlife, Portland, Oregon, USA.
- ODFW. 2016. 2002-2016 Rocky Mountain elk population estimates. Unpublished data.

- Parks, C.G., D.A. Conklin, L. Bednar, H. Maffei. 1999. Woodpecker use and fall rates of snags created by killing ponderosa pine infected with dwarf mistletoe. Res. Pap. PNW-RP-515. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 11pp.
- Partners in Flight. 2010. Central Rocky Mountains physiographic area plan. Accessed online at: <http://www.partnersinflight.org/bcps/pifplans.htm>.
- Penninger, M.A. Forest Wildlife Biologist, US Forest Service, Baker City, OR. [Personal communication]. 2011
- Penninger, M. and K. Keown. 2011a. American marten (*Martes americana*) indicator species assessment, Wallowa-Whitman National Forest. Unpublished report. 50 pp.
- Penninger, M. and K. Keown. 2011b. Northern goshawk (*Accipiter gentilis*) management indicator species assessment, Wallowa-Whitman National Forest. Unpublished report. 54 pp.
- Penninger, M. and K. Keown. 2011c. Pileated woodpecker (*Drycopus pileatus*) management indicator species assessment, Wallowa-Whitman National Forest. Unpublished report. 38 pp.
- Reynolds, R. T. Graham, M. H. Reiser, R. L. Bassett, P. L. Kennedy, D. A. Boyce, Jr., G. Goodwin, R. Smith, and E. L. Fisher. 1991. Management recommendations for the northern goshawk in the southwestern United States. USDA Forest Service, Southwestern Region, Albuquerque, NM. 184p.
- Reynolds, R. T., and H. M. Wight. 1978. Distribution, density, and productivity of accipiter hawks breeding in Oregon. *The Wilson Bulletin* 90(2):182-198.
- Reynolds, R. T., E. C. Meslow, and H. M. Wight. 1982. Nesting Habitat of Coexisting Accipiter in Oregon. *Journal of Wildlife Management* 46:124-138.
- Reynolds, R.T. 1983. Management of western coniferous forest habitat for nesting Accipiter hawks. Gen. Tech. Report RM-102. USDA Forest, Rocky Mountain Forest and Range Experiment Station. 7 p.
- Reynolds, R.T.; Graham, R.T.; Reiser, M.H.; Bassett, R.L.; Kennedy, P.L.; Boyce, D.A.; Goodwin, G.; Smith, R.; Fisher, E.L. 1992. Management recommendations for the northern goshawk in the southwestern United States. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, GTR-RM-217.
- Rohner, C., and F. I. Doyle. "FOOD-STRESSED GREAT HORNED OWL KILLS ADULT GOSHAWK-EXCEPTIONAL OBSERVATION OR COMMUNITY PROCESS." *Journal of Raptor Research* 26.4 (1992): 261-263.
- Rose, Cathy L., et al. "Decaying wood in Pacific Northwest forests: concepts and tools for habitat management." *Wildlife-habitat relationships in Oregon and Washington. Oregon State University Press, Corvallis* (2001): 580-623.
- Rosemberg, K.V., Kennedy, J.A., Dettmers, R., Ford, R.P., Reynolds, D., Alexander, J.D., Beardmore, C.J., Blancher, C.J., Bogart, R.E., Butcher, G.S., Camfield, A.F., Couturier, A., Demarest, W., Easton, W.E.,

- Giocomo, J.J., Keller, R.H., Mini, A.E., Panjabi, A.O., Pashley, D.N., Rich, T.D., Ruth, J.M., Stabins, H., Stanton, J., Will, T. 2016. Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States. Partners in Flight Science Committee. 119pp.
- Rowland, M.M., M.J. Wisdom, B.K. Johnson, and M.A. Penninger. 2005. Effects of roads on elk: implications for management in forested ecosystems. Pgs. 42-52 *in* Wisdom, M.J., tech. ed., The Starkey Project: a synthesis of long-term studies of elk and mule deer. Transactions of the North American Wildlife and Natural Resources Conference.
- Peek, J. M., J. J. Korol, D. Gay, and T. Hershey. 2001. Overstory-understory biomass changes over a 35-year period in southcentral Oregon. *Forest Ecology and Management* 150:267-277.
- Peek, J. M., B. Dennis, and T. Hershey. 2002. Predicting population trends of mule deer. *Journal of Wildlife Management* 66:729-736.
- Saab, V.A. and J. Dudley. 1998. Responses of cavity-nesting birds to stand-replacement fire and salvage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho. Res. Pap. RMRS_RP_11. Ogden, UT. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 17pp.
- Saab, V.A., J. Dudley, and W.L. Thompson. 2004. Factors influencing occupancy of nest cavities in recently burned forests. *The Condor* 106:20-36.
- Saab, V.A., R.E. Russell, and J.G. Dudley. 2007. Nest densities of cavity-nesting birds in relation to postfire salvage logging and time since wildfire. *Condor* 109:97-108.
- Salwasser, H., 1979. The ecology and management of the Devil's Garden Interstate Deer Herd and its range. Ph.D. Dissertation, University of California (Berkeley).
- Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2011. The North American Breeding Bird Survey, Results and Analysis 1966 - 2009. Version 3.23.2011 USGS Patuxent Wildlife Research Center, Laurel, MD.
- Schommer, T., E. Collard, and K. Wiedenmann. 1993. Wallowa-Whitman National Forest green tree snag replacement guidelines.
- Slauson, K. M., W. J. Zielinski, and J. P. Hayes. 2007. Habitat selection by American martens in coastal California. *Journal of Wildlife Management* 71:458-468.
- Sousa, P.J. 1982. Habitat suitability index models: Lewis' woodpecker. U.S. Dept. Interior, Fish and Wildlife Service. FWS/OBS-82/10.32. 14p.
- Squires, J. R. and P. L. Kennedy. 2006. Northern Goshawk Ecology: An Assessment of Current Knowledge and Information Needs for Conservation and Management. *Studies in Avian Biology* No. 31:8-62.

- Squires, J.R. and R. T. Reynolds. 1997. Northern Goshawk (*Accipiter gentilis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/298>.
- Stephens, S.L. and J.L. Moghaddas. 2005. Fuel treatment effects on snags and coarse woody debris in a Sierra Nevada mixed conifer forest. *Forest Ecology and Management* 214:53-64.
- Stevens, V. 1997. The ecological role of coarse woody debris: an overview of the ecological importance of CWD in B.C. forests. Res. B.C. Min. For., Victoria. Working Paper 30/1997. 26 pp.
- Thomas, J. W., ed. 1979. Wildlife habitats in managed forests: The Blue Mountains of Oregon and Washington. Agricultural Handbook No. 553. USDA Forest Service. Washington D.C. 512p.
- Thomas, J.W., D.A. Leckenby, M. Henjum, R.J. Pederson, and L.D. Bryant. 1988. Habitat-Effectiveness Index for Elk on Blue Mountain Winter Range. USDA Forest Service, Pacific Northwest Research Station, General Technical Report PNW-GTR-218.
- Unsworth, J. W., D. F. Pac, G. C. White, and R. M. Bartmann. 1999. Mule deer survival in Colorado, Idaho, and Montana. *The Journal of Wildlife Management*:315-326.
- USDA Forest Service. 1990. Land and Resource Management Plan, Wallowa-Whitman National Forest. USDA, Forest Service, Pacific Northwest Region (R6), Wallowa-Whitman National Forest.
- USDA Forest Service. 1993. Region 6 Interim Old Growth Definitions. USDA, Forest Service, Pacific Northwest Region (R6).
- Wales, B. C., K. Mellen-McClean, W. L. Gaines and L. Suring (2011). Focal species assessment of current condition and the proposed action (alternative B) for the Blue Mountains forest plan revision-DRAFT. Baker City, OR, Unpublished paper on file at: U.S. Department of Agriculture Forest Service, Wallowa-Whitman National Forest, Blue Mountain Forest Plan Revision.
- Wallmo, O. C. 1978. Mule and black-tailed deer. Pages 31-42 in J. L. Schmidt, and D. L. Gilbert, editors. *Big game of North America*. Stackpole Books, Harrisburg, Penn.
- WHCWG. 2011. Washington Wildlife Habitat Connectivity Working Group. Accessed online September 2011 at: <http://waconnected.org/statewide-analysis/>.
- Workman, G. W., and J. B. Low. 1976. Mule Deer Decline in the West: A Symposium. Utah Agricultural Experiment Station, Logan, UT
- Wisdom, M.J., R.S. Holthausen, B.C. Wales, C.D. Hargis, V.A. Saab, D.C. Lee, W.J. Hann, T.D. Rich, M.M. Rowland, W.J. Murphy, and M.R. Eames. 2000. Source habitats for terrestrial vertebrates of focus in the interior Columbia Basin: Broad-scale trends and management implications, Vol. 2 – Group level results. Gen. Tech. Rep. Threatened and Endangered Species, Sensitive Species and Management Indicator Species and the level of analysis required. PNW-GTR-485.